Electrical Review

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Electrical Review

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THE FOURTH AVENUE TUNNEL.

The remarks made in this column recently, concerning the urgent necessity for electrical equipment of the railway lines in the tunnel running north from the Grand Central Station, in New York city, have been made the subject of no little comment on the part of the daily press.

The subject is essentially one of live importance, particularly to the large number of people dwelling within a radius of 50 or 60 miles north and east of New York, and compelled to use the railway lines passing through this tunnel more or less frequently. Perhaps the most curious statement that has come out of the discussion of the subject is one contained in an article in a prominent daily newspaper of New York, purporting to be an interview with the general superintendent of one of the interested railroads. In this he is alleged to have said that changes of motors can not be made at any point near the Grand Central Station, and that so far no electrical motor has been made which will be able to perform the service required.

As far as the former question is concerned, it stands absolutely to reason that all that is necessary for switching is a properly constructed switchyard. There is an abundance of yard room in the vicinity of the natural switching point—Mott Haven station—upon which such switches and sidings as are necessary might easily be erected. There is really no necessity, however, for any exchange of locomotives for electric motors, or *vice versa,* since experience in the tunnel in Baltimore has proven that the locomotive can be hauled through the tunnel along with the rest of the train, its dampers closed, without giving off enough gases and smoke to make it seriously objectionable. The most modest and simple kind of mechanical ventilation applied to the tunnels through which locomotives are thus hauled is sufficient to keep them entirely clean. The better way, however, will be found to be the replacing outside the city limits, of smokestacks and fireboxes by the almost noiseless and entirely odorless electric locomotives.

The other suggestion is the astonishing one. The ELECTRICAL REVIEW will be pleased to furnish to the management of the interested railroads a list of about a dozen contracting companies of the highest commercial reputation and having ample capital, any of whom would gladly undertake to construct the plant and maintain it for a reasonable period in operative condition. We can not refrain from suggesting a conference of the railroad owners with George Westinghouse, Charles A. Coffin, Frank J. Sprague, A. M. Young, John B. McDonald, J. G. White or men of similar electrical and constructing experience.

There is no question that sooner or later all the suburban service of a city of suburbs like New York must be operated by electricity. Heavy trains, hauled at unfrequent intervals by steam locomotives, can not compete in convenience or earning power with even the simple trolley line for this variety of service. This means that sooner or later the lines extending from this station, and, for that matter, from the other railway stations in the city and on the New Jersey side of the Hudson River, necessarily must be converted into electric lines. The tunnel is a good place to begin.

Doubtless the convincing arguments presented by the present state of the Fourth Avenue tunnel and the perfect ease with which its discomforts can be ameliorated will have their effect within a short time upon the railroad managements which have already shown so much ability of a high order in the conduct of their affairs.

FASHIONS IN ENGINEERING.

The tendency to devise new apparatus and methods, and for invention to replace older and less effective means in engineering with newer and more efficient ways of doing things, is hardly more marked than another tendency which causes strict adherence to old and established forms and ways. There is scarcely any more proper descriptive name that can be applied to the latter tendency than that of fashion, because, after all, human beings strongly resemble sheep in their tendency to follow one another, to submit to the bondage of fashion, and to stick close to the established precedent.

In electrical engineering this particular tendency has been marked in several directions; for example, in Professor Perrine's paper in the last issue, we are told that strict adherence to ancient methods of making and regulating impulse water wheels has been highly detrimental to good regulation in certain of the large power plants in the western states. While the inventor seems to have been able to devise an impulse wheel, which is better, in many respects, than any other form of waterwheel for the purpose to which it is applied, the engineer and manufacturer seem not to have been able to go beyond this one step, and endeavor to make each of their plants as much as possible like every other.

It is evident to any intelligent observation that much of the success which has attended the progress of engineering in this country, especially in its electrical developments, has been due to the standardization of apparatus and parts and to a wise adherence to established methods in installation and construction. Just the other tendency—the desire to specialize each plant and to make every installation a theatre for the exploitation of original designs in machines and modes of operation—has worked greatly to the detriment of British and French electricians. They have not been able to secure the extraordinary advantages which follow thorough standardization of manufacture in such important parts of installation as machines, dynamos, waterwheels, engines, insulators, etc. It has seemed to each consulting or constructing engineer that he should design anew all of the parts of the plant he is building, and this tendency on his part has produced two results which are by no means an assistance to progress. One of them is the high cost of making new machines from new designs and new patterns for each installation, and the other is due to the fact that electrical engineering has grown so large that no one man can know thoroughly all the details of its application. For this reason the designs made originally for each particular case have not always the highest merit, nor have machines made upon practically new models achieved the success in operation which comes from the adoption, after much experiment, of a standard type and the exercise upon that of all the ingenuity, skill and experience which the manufacturer can accumulate.

This is one side of the question; the other side, which may briefly be summed up as the American tendency to follow blindly precedent in installation and to use invariably standard machines for all purposes, has certain advantages in practice, but itself is coupled with serious drawbacks. Unquestionably, the proper fashion in engineering should be the combination of the European's instinctive desire to construct a new design on each occasion, and the American's conservative tendency to use continually over and over again the types of apparatus which have proven successful in reasonably similar cases in the past.

This view of the case does not necessarily require that we should depart in any way from the great advantages that have come through standardization of parts, sizes and designs of apparatus. Rather, it seems that we should continue to use these, but with them we should exercise also a little freedom in the design of their grouping and their application to produce definite results. At the same time, it would do no harm should the elements of æsthetics be taught in our engineering schools and thus perhaps lead us, in time, to avoid the exceeding hideousness of appearance which disfigures many designs otherwise excellent. Take the case of the automobile, for example, and fancy what this vehicle would have become had its designers leaned a little more toward the side of beauty and a little less toward the conservatism that decrees only one type for all vehicles that run on wheels.

It is even conceivable that too strict conservatism on our part may eventually lead to some such difficulties as those that have come from a precisely opposite course on the part of our brethren in Europe. Nobody can fairly say that the American engineer is not original, but it seems a fair criticism that he has not always exercised his unquestioned ability in this direction. We see trolley roads and electric light plants, and isolated plants and all manner of electrical installations repeating themselves with ominous persistence. Granting that a design for such an installation is good, it is always a fair question to ask if it might not be made better. It is earnestly to be hoped, therefore, that the real adaptability and originality of our race should not be hampered by the seemingly increasing bonds of fashion in engineering, but that, while adhering as far as possible to our standards and keeping as well as may be within the limits of our tried experience, we may still exercise, in some degree, that originality which is a sign and trademark of the man made in the United States.

Observation leads one to the conclusion that there is no industrial field which is so skilfully and successfully advertised as the electrical. Whether it be advertising in the journals devoted to the industry, or booklets and bulletins issued for special purposes, or circulars, or catalogues, the average quality of the letter press, the illustrations and the mechanical execution is very high. Some of the most effective advertising ever done has appeared in the electrical weeklies, and here, to a large extent, lies the measure of tremendous success which electrical manufacturers have achieved.

The forthcoming convention of the Association of Edison Illuminating Companies, which will meet at Saratoga, N. Y., on September 4, 5 and 6, promises to be a great success. This association, while restricted in its membership, has done great work in the field of endeavor which its members are developing.

CONDENSERS AND ECONOMIZERS.

BY ALTON D. ADAMS.

Fuel economy, from exhaust steam and flue gases, is too frequently neglected at electric stations. As to exhaust steam, the lack of economical operation is most notable with simple engines, though both the simple and compound types are frequently used without condensers. Present practice seems to indicate an impression in the management of some stations that while condensers are a very good thing, their use with simple engines is of minor importance. Where the economy of compound over simple engines has been attained, there seems to be a much stronger disposition to secure the further economy of condensers than in those cases where the simple engine continues in use. The fact is that there is little or nothing in the history, theory or practice of steam engineering to warrant the more general use of condensers with compound than with simple engines. The condenser increases the mean effective pressure for engine cylinders, exhausting into it by about 12 pounds, depending on the degree of vacuum maintained. This increase of pressure, without any corresponding consumption of steam, effects a saving of as much as 20 per cent in the weight of steam used per horse-power of work, in both the simple and compound engine. Engine capacity is also increased by the ratio of the vacuum, or, say, 12 pounds to the mean effective pressure of steam from the boiler. This increase in engine capacity can, of course, be got also by a higher boiler pressure, unless the limit in this direction has already been reached, but only by a nearly corresponding addition to the weight of steam consumed. In fact, a point is soon reached in the steam pressure for any type of engine where its further increase results in a larger consumption per horse-power.

An objection to the use of condensers that has more or less weight, according to circumstances, is the cost of condensing water. In the first instance, the weight of water required by a condenser per pound of the exhaust steam varies with the water temperature. Each pound of water absorbs nearly one heat unit for each degree Fahrenheit through which its temperature is raised. The temperature of steam corresponding to a vacuum of 24 inches of mercury, or 12 pounds per square inch, is 140 degrees, but the actual temperature in the hot well at this pressure is nearer 120 degrees. If the condensing water is warmed to 100 degrees, which is about all that can be expected, the heat units absorbed by each pound of water raised from 40 degrees, are 60, but if the temperature of the water at the start is 70 degrees, each pound can only absorb 30 heat units. A condenser just large enough in Winter would thus be much too small in Summer. At an absolute pressure of three pounds per square inch, or a vacuum of nearly 12 pounds per square inch, one pound of steam contains 1,015 latent units of heat, which it must give up when condensed. If each pound of water used in the condenser absorbs 40 heat units, about 25 pounds of water must be used per pound of steam condensed. The older practice is to reject entirely the hot water after it has served its purpose once in a condenser. Where sea or river water can be had freely for condenser use, its total rejection, when heated, is still the best practice. If water must be taken from the city supply and paid for, it is much cheaper to cool it and use it over and over in the condenser, than to reject it at once when heated.

Several forms of cooling apparatus for condenser water have been devised, all acting on the principle that hot water, when spread over a large surface, cools rapidly by evaporation. One plan is to expose the hot water in a series of shallow, inclined pans, pumping it into the highest pan, whence it runs down over the others. Some water is lost by evaporation, but this is only a small per cent of the total condensing water at a single heating. The use of condensers is, in some cases, objected to because the temperature to which feed water can be raised with the exhaust steam is thereby reduced. With the exhaust at air pressure, feed water may be raised to a temperature of about 212 degrees, but in a condenser with a vacuum of 24 inches, feed water can not be heated much above 110 degrees. On a little consideration it is seen that this objection to the use of condensers has not much weight; first, because the additional heat that could be added to feed water by exhaust steam at air pressure is a comparatively small matter, and, second, because other means exist by which feed water may be raised to even higher temperatures than are possible with exhaust steam. Feed water heated from 40 to 212 degrees absorbs 173 units per pound. As the latent heat of steam at air pressure is about 966 heat units per pound, only 18 per cent of this amount of latent heat can be absorbed per pound of feed water and the remainder goes to waste when steam is exhausted at the open-air pressure. If the feed water is heated to 110 degrees, as it may be in a condenser, there remains a deficiency of only 102 heat units per pound below the amount of heat that might be added to the feed by exhaust at atmospheric pressure. These 102 heat units represent less than nine per cent of the heat that must be applied to one pound of water at a temperature of 40 degress to convert it into steam at 100 pounds gauge pressure. As an offset to this loss of nine per cent of the total heat required for steam production, the condenser effects an economy as great as 20 per cent in the consumption of steam for a given amount of work. Even if no other means was at hand to heat the feed water above the temperature of 110 degrees that may be had in a condenser, the gain in economy of steam per unit of work would be twice the loss due to the low temperature of the feed water. The heat of the flue gases is, however, readily available to raise the temperature of feed water as high as or even above that possible with exhaust at open-air pressure.

Flue gases usually enter the chimney at temperatures of 500 to 600 degrees Fahrenheit, where economizers are not used, and it is not practicable to greatly lower these temperatures by extensions of the boiler surface. Economizers, however, can receive the flue gases as they leave the boiler and reduce their temperatures by 200 to 300 degrees. The gases resulting from the complete combustion of one pound of coal, allow an air dilution of 100 per cent, weighing 25 pounds, and at a temperature of 600 degrees, contain fully 300 units of heat. This heat is extracted from the gases in nearly the proportion that their temperature is lowered.

Boiler steam at 100 pounds gauge pressure has a temperature of nearly 338 degrees and the nearer to the steam temperature the feed water can be brought before it enters the boiler, the greater will be the evaporation per pound of coal burned. High temperature of the heat in flue gases is thus more favorable to the best results with the feed water than is exhaust steam at open-air pressure. The evaporation of nine pounds of water from and at 212 degrees per pound of coal burned, corresponds to a boiler efficiency of 70 per cent, with coal yielding 12,500 heat units per pound on perfect combustion. If the nine pounds of feed water that are to be evaporated by one pound of coal are heated to a temperature of 110 degrees in a condenser, about 1,270 heat units must be added from some other source to bring the water up to 250 degrees. If the 25 pounds of flue gases from one pound of coal are reduced in temperature about 260 degrees they yield 1,300 heat units, or fully

enough to heat the nine pounds of feed water to a temperature of 250 degrees. Provided that the flue gases leave the boiler a temperature of 600 degrees, the reduction by 260 still leaves these gases at 340 degrees temperature, or an ample margin over that of the feed water at 250 degrees. The economizer, by extracting 1,300 heat units from the flue gases per pound of coal burned, increases the efficiency of the boiler plant by fully 10 per cent of the total energy in fuel. As this saving of heat by economizers raises the feed water to a higher temperature than it could reach with the exhaust steam at open-air pressure, the average economy of 20 per cent in fuel effected by the use of condensers with either simple or compound engines remains as a net result. It may be objected to the use of economizers that the reduction of temperatures in flue gases lowers the draft and more than offsets any saving in the feed water by the bad effect on combustion.

If chimney draft was the only sort available the objection just stated to economizers would hold good. It is possible, however, to make good any reduction of in draft due to a lower temperature of flue gases, by an expenditure of steam that represents only a small equivalent of the heat saved. Chimney draft, of course, results from the differences in temperature and density of the gases inside and the air outside. Mechanical draft can maintain any desired rate of air supply to the fire, on a consumption of steam that contains heat in amount not greater than one-tenth of the waste in flue gases for an equal effect. Economizers have another advantage beyond the saving of fuel, that is of special value in central electric stations. Large and rapid increase of station outputs is hardest to meet at steam boilers, but an economizer full of water at a temperature of 250 degress or more represents stored energy that may be rapidly transferred to steam.

Street Railway Association of the State of New York.

The eighteenth annual convention of the Street Railway Association of the state of New York will be held at Buffalo, on Tuesday and Wednesday, September 18 and 19, instead of on September 11 and 12 as previously announced. This change was made necessary in order to secure sufficient hotel accommodations. Owing to a number of other conventions which will be held at Buffalo during the week commencing September 10, the hotels will be overcrowded, and the street railway convention date was of necessity changed. Mr. G. Tracy Rogers, president of the Binghamton Railroad Company, Binghamton, N. Y., is president of the association.

THE JUNGFRAU ELECTRIC RAILWAY.

THE HIGHEST RAILROAD IN EUROPE—A REMARKABLE FEAT OF ELECTRICAL ENGINEERING — PROGRESS OF THE WORK AND PRESENT CONDITION OF THE LINE.

The Jungfrau is one of the most famous mountains in Europe. Rising in the middle of the Bernese Oberland to a height of 13,600 feet, the mountain for years resisted all attempts of Alpine climbers to reach its summit and probably on this account, as well as because of the exceeding beauty of its outlines and the whiteness and extent of the vast snow fields that cover its summit, it received the poetical name of Jungfrau—the Maiden.

The mountain was first ascended in 1811 and in the next forty years only five attempts at an ascent were made. It was considered a very perilous ascent, even more so than that of Matterhorn, but the view from the summit is one of the very finest in Europe and for this reason several plans were suggested whereby it could be made in some way available to tourists and others interested in mountain scenery. Nothing of a practical nature was done until, in 1890, Herr Guyer Teller, of Lausanne, Switzerland, proposed the plan which is now in course of execution and which promises to result in the most astonishing piece of railway construction and electrical engineering in Europe. The first work that was done on the project was a careful survey of the mountain by a geologist and a study of the possible dangers that might result from the rarefaction of the air at the great elevations proposed for the line. After a period of discussion which was at times acrimonious, the Swiss Federal Assembly finally granted in 1894 a concession for the work to Herr Teller and his associates. Unfortunately, this hardy pioneer died in the Spring of 1899, and his death was a severe blow to the enterprise with which he was so prominently connected.

The scheme of the road is exceedingly simple. It proceeds from a point called the Little Scheidegg, which is a railway station on a regular line of steam railroad, by a steady grade, part of the way in the open air and the rest of the way in a tunnel with an average grade of 15 per cent, to a point about 150 feet below the summit of the mountain. An elevator from this terminal station lands the passengers on the summit. The electrical equipment of the railway consists of rack locomotives operated directly by three-phase currents at 500 volts between the phases. The power is generated at the village of Lauterbrunnen, where are situated some of the most beautiful cataracts in Switzerland.

At a point above the village of Lauterbrunnen a small stream is dammed and gives a steady water-power estimated at a little over 2,000 horse-power. At present this is sufficient, but in the future it is probable that a second generating station will be erected, using the waters of another mountain stream and capable of generating 9,000 horse-power.

From the pond formed by damming the little stream, which is called the Weisser Lütschiner, a metallic conduit about six feet in diameter leads to the power plant about one and one-quarter miles down the valley. The total fall available is 130 feet. The head of the conduit is provided with gates, overflows and strainers. There are already installed six turbines, two of 800 horse-power and two of 500 horse-power each, and two small machines for driving the exciters, all of the wheels being of the Girard type in pairs on horizontal shafts. The large wheels run at 380 revolutions per minute, the smaller ones at 700 revolutions, automatic speed regulation being, of course, provided for each wheel. The exciter wheels and exciters are in duplicate.

As stated above, the lower part of the line is constructed on the surface of the ground, while the upper part is in a tunnel. One of the illustrations shows the mouth of the tunnel leading into the Eiger mountain, through which and the Jungfrau proper it continues until the summit of the latter is reached. In the face of the cliff, known as the Rothstock, a station has been blasted out so that passengers may enjoy the view from this point during a brief stoppage of the train. From the power station to the mouth of the tunnel the distance is about six and one-quarter miles; along this stretch feed wires are carried at a pressure of 7,000 volts, three-phase, the line being mounted on porcelain insulators supported by wooden poles. The diameter of the feed wire is about seven and one-half millimetres (0.3 inch). Through the tunnel the feed wire is led in concentric cables buried in a ditch at one side of the track. At the entrance of the tunnel the line is about 5,000 feet above the sea-level. In calculating the feed wires a loss of 10 per cent was allowed.

Transformer and converter substations are scattered along the line at intervals depending upon the nature of the grades. They are about one and three-quarter miles apart where the grade does not

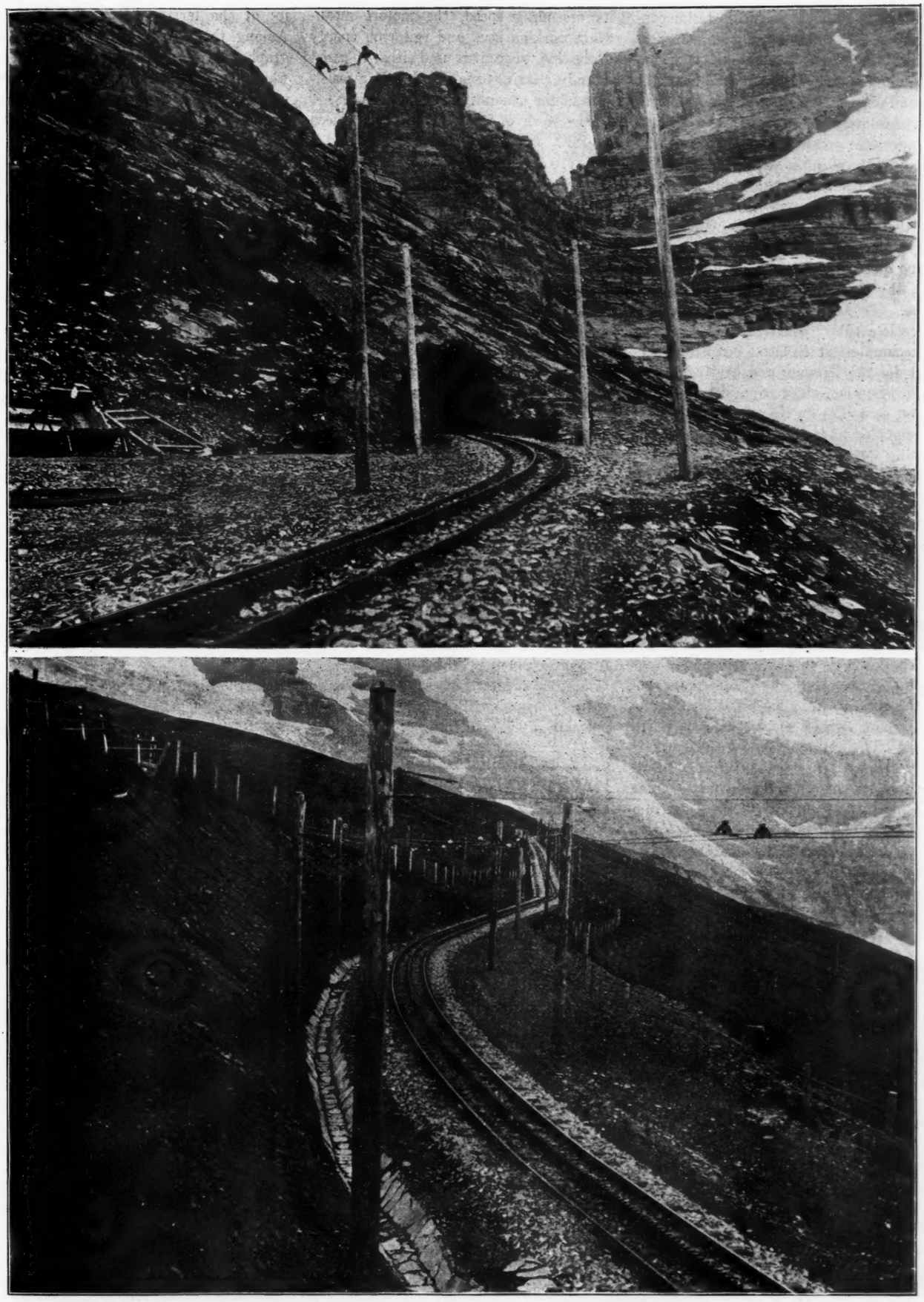


FIG. 1.—THE MOUTH OF THE EIGER TUNNEL ON THE JUNGFRAU ELECTRIC RAILWAY, LEADING TO THE EIGER STATION, 7,950 FEET ABOVE SEA LEVEL
FIG. 2.—LOOKING DOWN THE GRADE ON THE JUNGFRAU ELECTRIC RAILWAY FROM THE MOUTH OF THE EIGER TUNNEL.

exceed 15 per cent. Each sub-station contains three 200-kilowatt transformers which, like all the other high-tension apparatus, are carefully insulated from the ground on porcelain insulators—a precaution absolutely necessary in regions where thunder storms are so frequent and violent as they are in the Alps.

The rooms for the substations in the tunnel are blasted out of the solid rock. At the stations, such as Scheidegg, the Eiger glacier and others, where there are living quarters for employees, restaurants, etc., the installation is much more complete. In addition to the transformers there is a rotary converter and a battery of accumulators, the latter furnishing current for the lighting and heating of the buildings when the current is cut off at night, as well as for the supply of the tunnel lighting in case of accident to the generating station.

Current on the line is maintained at 500 volts in each phase with a maximum loss of 12 per cent between any two substations. The two conductors composing the trolley line are of hard-drawn copper wire nine millimetres (0.354 inch) in diameter, suspended 16 inches apart. The third conductor of the three-phase system is the rails, which are well bonded and earthed.

The locomotives weigh about 12½ tons each and each carries two three-phase motors geared by a double reduction gear to the pinion wheel which engages in the rack. The construction of the track is well shown in the preceding illustrations, one of which represents the grade leading up to the mouth of the Eiger tunnel, a portion of the Jungfrau being shown in the background. This illustration gives an excellent idea of the character of the overhead line and track construction. It will be noticed that the poles are provided with cast-iron caps, the construction otherwise being practically identical with that of the ordinary American trolley road. The locomotives develop about 300 horsepower as a maximum and each hauls a train weighing 29 tons and seating 80 passengers. The forward end of the first car is supported on a prolongation of the rear truck of the locomotive so that its weight assists the tractive effort of the latter. The trains go up the mountain backwards; that is, the locomotive is always at the down hill end of the train, pushing it up the grade and rolling back in front of it. On the down trip the motors are connected with the line as in the up trip, but on account of the well-known tendency of the induction motor to stay in step with the current, the descending speed of the train is little greater than its ascending speed, the motors meanwhile working back and restoring energy to the line, where it is used either to assist ascending trains or is absorbed in a resistance at the generating station.

The work of construction commenced in 1897, and at present has attained a point 10,595 feet from the Little Scheidegg Station. On account of the constant grade, in case of any accident, the trains could return under their brakes to the station with safety. The first mile and a half of the line, which is in the open, presented no particular difficulty, but this has not been the case with the tunnel section. The first half of the tunnel will penetrate a hard, calcareous rock and the upper half of it will be built in hard schist and gneissic rock. The hardness and solidity of this rock renders any masonry work for lining the tunnel entirely unnecessary. Electric percussion drills have been used in the work and experiments have been undertaken with liquid air as a blasting agent, but no great success has been achieved with it. The present explosive compound is nitro-gelatine, and this, in contrast with other nitro explosives, is more dangerous and liable to detonation when cold than when warm. In consequence, the supply of the explosive is kept in rooms heated by electric heaters so as to keep it warm. It is expected that the entire project of the Jungfrau Railway will be completed in from 8 to 10 years.

VIEWS, NEWS AND INTERVIEWS

The Berlin Academy of Sciences has made a grant of 750 marks to Professor Adolf Schmidt, of Gotha, for the collating and publication of material on terrestrial magnetism.

The production of platinum in Russia is increasing both in quantity and value. The Ural mountains furnish 95 per cent of the world's supply of this valuable metal. During 1899, the Ural region afforded 13,242 pounds of platinum as against 6,363 pounds in 1890.

Under date of Birmingham, July 13, 1900, United States Consul Marshal Halstead reports that at the annual general meeting of the Electric Construction Company, in London, the chairman announced that the company had sent to Paris, at a moderate expense, over 20 leading employees, in order that they might see in the exposition what is being done in the electric machinery world abroad.

During the recent hot spell, many stories of the terrific heat got into print. Among them was one which was telegraphed from Cleveland, Ohio, and which read as follows: "A plate-glass window, 12 feet by 8 feet, broke under the action of the sun's rays. The window was in the office of the Postal Telegraph Company, in the Perry Payne Block. The thermometer was 92 degress in the shade at noon."

Steam power is to be superseded by electricity to a very considerable extent in the government dockyard at Kiel, Germany. After experimenting with electric power transmission on a comparatively small scale, the administration has now decided upon a scheme whereby all the machine tools, etc., installed in the different workshops are to be electrically driven. To this end, a power plant having a capacity of 3,500 horse-power is to be erected. This plant will also supply electrical energy for driving the powerful dockyard pumps.

The modern demand for high-power machinery is shown by a comparison of the machinery exhibited at the last four world's expositions at Paris. In 1867, there were exhibited and operated 52 machines, with an aggregate of 854 horsepower; in 1878, 41 machines, aggregating 2,533 horse-power; in 1889, 32 machines, with 5,320 horse-power, and in 1900, 37 machines, with 36,085 horsepower. The average horse-power per machine exhibited in 1867 was 16; in 1878, 62; in 1889, 170, and in 1900, 973. France this year exhibits and operates 18 machines, with an aggregate of 14,435 and an average of 802 horse-power. Other countries operate 19 machines, with 21,650, or an average of 1,140, horsepower.

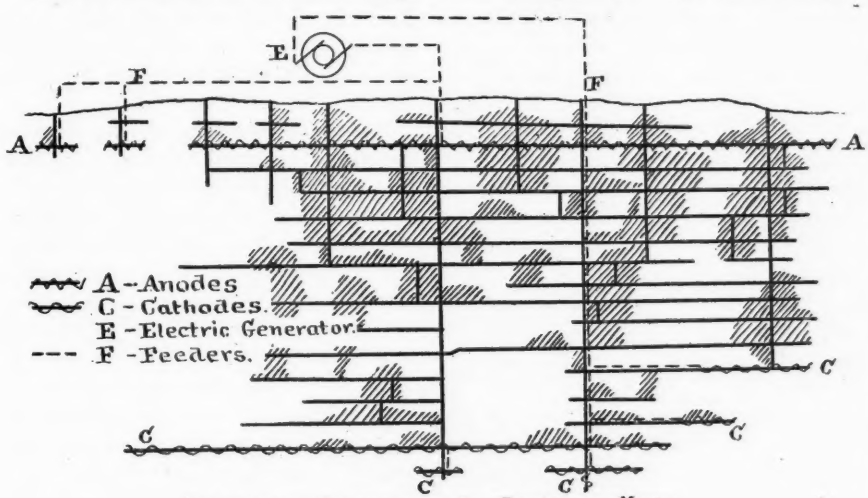
"It is strange that people should think the electric boat is the most recent development of applied electricity," said a traveled engineer in conversation the other day. "As a matter of fact, the electric boat was one of the very first applications of the electric motor. In 1838, Morritz Hermann Jacobi, a celebrated German physicist, at that time living in St. Petersburg, made an electric motor of one or two horse-power, using bar electromagnets, and adapted it to a boat which he operated on the River Neva. He used primary batteries, of course, as his source of power. Jacobi grew to be a man of great influence and importance in scientific matters in Russia, becoming a member of the Academy of Sciences and a Councillor of State. He invented the process of electrotyping in 1839, and constructed the first electric power motor that was made."

Electrolytic Formation of Ore Deposits in Mines.

Under the above caption Mr. Story B. Ladd writes to the *Engineering and Mining Journal* the following interesting letter, which is illustrated by the accompanying diagram:

There are many mines which have been worked to a considerable extent, but have ceased to be profitable under existing conditions. They are opened up by shafts and drifts, as well as stoped areas, but have bodies of unworked ground, either unexplored or of too low a grade to stope and mill or smelt; they are flooded or can be flooded, and thus present conditions are favorable for working according to the method now proposed.

If such a mine be converted into a huge electrolytic cell, with anode and cathode districts and lines of electric flow created through the workings and the ore bodies, there will take place a movement of the metal values, from the deposits in situ, toward the cathode centres, and the formation of rich ore deposits in and about such points, and in this way it may be possible to work certain old mines, particularly where water power is available for electric generation.



ELECTROLYTIC FORMATION OF ORE DEPOSITS IN MINES.

Lines of electric flow may be created by placing the anodes in the upper drifts or stopes, and the cathodes at the bottom of the shafts and in the lower drifts; or the lines of electric action may extend horizontally along the vein by using one or more shafts for anode chambers and placing the cathodes in other shafts or workings. As the lines of flow between two terminals assume an ovoid form, in a homogeneous medium, the electrolytic action will be felt throughout the intervening territory, through the seams and fissures and the water-saturated ground, and not alone through the open workings.

The accompanying sketch illustrates the suggestion: A, A being the anode chambers; C, C the cathodes; E an electric generator, and F, F the feeders.

The cathodes should, preferably, be placed in the bottom workings and they may be distributed in the lower drifts for the entire length of the property; the anodes being distributed in and through the upper drifts just below the flood line. Cathode plates may be hung in the bottom drifts, or plates may be laid on the floor of the drift and low-grade ore banked thereon. The deposited values will fill the interstices of the mass, working upward from the plates, and convert the body into bonanza ore. There will be reproduced the conditions existing in a vein formation, and in the interstices of the mass we shall have the fissures, seams and cavities of a shattered vein to be filled with rich mineral deposits, through the electrolytic action there centering. With a run, say, for a year, with a heavy current of low voltage, such a cathode mass will become a body of high-grade ore, to be removed and the chambers and drifts again charged for another run. The operation would be repeated until all metal values in the electrolytic field have progressively reached the cathode territory and the mine is electrolytically exhausted. Experiments alone would show whether the deposition on and about plates direct, or within an interstitial mass, gives the best results. The anodes could be advantageously formed of plates—lead, for example—buried in crushed coke.

The mine water can be slightly acidulated and made a good electrolyte when necessary by distributing tons of acid (salt or chemicals) through the workings prior to flooding the mine. The feeders or mains leading down to the cathodes will necessarily have to be most carefully insulated, and all iron structures that would short circuit the current removed.

All operating expenses, after installation, reduce down to electric generation, the pumping out of the mine at long intervals, and the mining of known bodies of high-grade ore with the approches thereto established.

The Chicago Subway.

Detailed plans for the construction of a down-town subway system in Chicago, at an estimated cost of $20,000,000, were given to the street railway commission of that city recently by President John M. Roach, of the Union Traction Company. In drawing the plans it was said that the best features had been selected from the underground systems of Budapest, London, New York and Boston. The plans were received by the commission as representing the ideas of the street car men, and were considered simply as engineering proposals, without reference to the questions of municipal ownership, compensation or franchise extension which are involved in the subway proposition. The plans include provision for another river tunnel, at Dearborn street, to be used for North Side lines. They provide for a central transfer station on all lines. This is to be located in Madison street, between State and Dearborn streets. All loops will touch the block at some point, enabling transfer to any part of the city. All West and South Side loops will reach the new post office and better mail-carrying facilities will be afforded. Six loops are provided by the plans of the traction company. The construction of another river tunnel will enable a division of the North Side lines. The Wells street cables will use the La Salle street tunnel and the Clark street line the new tunnel in Dearborn street. Lines entering the La Salle street tunnel will be operated from La Salle to Madison to Dearborn to La Salle. Those entering the Dearborn street tunnel will run in Dearborn, Madison, State and Randolph streets. The loop emerging from the Washington street tunnel will be laid in Franklin, Monroe, Dearborn, Madison, Franklin and Washington streets; the loop from the Van Buren street tunnel in Franklin, Adams, State, Madison, Dearborn and Monroe streets. By consolidation of the Wabash avenue and State street cable lines on State street at Hubbard Court one loop will be used for both lines, running in State, Jackson, Randolph, State, Madison, Michigan, Jackson and State streets. The estimates of the cost of construction have been doubled over those submitted with the general proposition first made by the company. The first estimate was $1,000,000 a mile for 10 miles of underground tracks. The present estimate is $2,000,000 a mile. The plans, as worked out in detail, provide for a system of pipes, wires and conduits in connection with the subway. This addition caused the increase in estimates. Provision is made for the carrying of gas mains above the subway for the safety of traffic underground.

SCIENCE BREVITIES

The Earth's Magnetism—In the course of a contribution to the *Elektrotechnische Zeitschrift* upon the subject of the generation of thermo-electric currents, Herr von H. Egg-Sieberg makes some interesting deductions concerning the earth's magnetism, says a British contemporary. From the experiments which he describes, the author concludes that the magnetic influence exerted by the earth at any point must be strongest when the maximum fall of temperature occurs at that point. This assumption would explain the daily fluctuations of the earth's magnetic influence, and, at the same time, the circumstance that these daily fluctuations are greatest in the Summer and smallest in Winter. Assuming the aurora to be caused by the discharge of atmospheric electricity into the earth's surface, it is probable, continues the author, that the local direction of the earth's current is thereby so modified that the lines of force vary in the manner observed upon the appearance of the phenomena in question. Finally, it is conceivable to the author that the earth's current may undergo an appreciable change through momentarily great changes of the earth's surface caused by earthquakes and volcanic eruptions, disturbances of the magnetic needle such as have been observed on such occasions being thereby entailed.

Mast Wires in Space Telegraphy—Herr A. Lindemann has completed a systematic study of the precise influence of the mast wire upon the intensity and the wave length of the system of waves emitted by a Righi oscillator, says an *Electrician* abstract. He used a horizontal arrangement for the latter, and was thus enabled to attach auxiliary wires on both sides. He found that such an oscillator emits two superimposed wave trains, one of which has the same wave length as that emitted by the oscillator without the wires, while the other has a greater wave length, determined by the period of the whole oscillating system consisting of the balls of the oscillator and the wires joined by air sparks. The effect of the wires upon the original wave train of the oscillator is to strengthen it, since waves of the same length, but less damped, are emitted by the wires. The advantage of the wires is the greater the shorter the air gap separating them from the oscillator. As the air gap increases the amplitude of oscillation of the whole system decreases in comparison with the amplitude of the original oscillation, and the dampening factor increases. When one of the "feelers" was put to earth and the other left in position, thus approximating to the arrangement used by Marconi, the second wave system could no longer be proved to exist. At least, its wave length could no longer be determined. Otherwise the phenomena were the same.

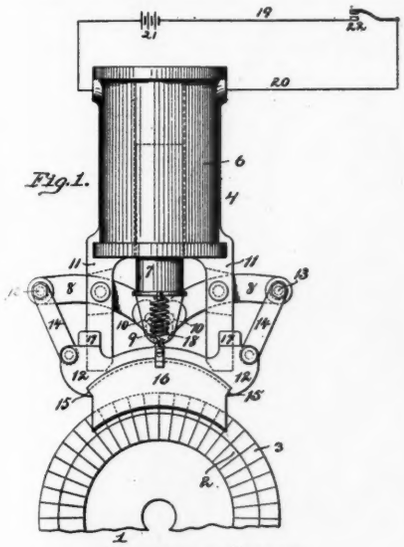
Kinetic Theory of Metallic Conduction—The laws of metallic conduction will probably soon be brought completely under the theory of electrons, which has lately succeeded in establishing some important fundamental relations between the phenomena of heat, of resistance and of electrolysis. The ratio of the two conductivities of a metal may be approximately calculated by Drude's electron theory, which involves the number of gas molecules per gramme and Thomson's value of the elementary electric charge, writes Mr. E. E. Fournier d'Albe. M. Reinganum points out that these two numbers, both somewhat roughly determined, are not really necessary at all, and that the much better known values of the electro-chemical equivalent and the velocity of hydrogen atoms in a gas may be substituted for them. This substitution gives for the ratio of thermal to electric conductivity the number 0.7099×10^{-10}, which is in remarkably close agreement with the experimental values found by Jâger and Diesselhorst, such as 0.706×10^{-10} for aluminum. In this agreement the author sees a proof that in metals also, as in liquids, electricity moves in separate quantities of the value of the quantities transported by electrolytic ions, and that the principles of the kinetic theory of gases apply to both. If that is the case, our knowledge of the material convection of electricity is about to become as complete as our acquaintance with the ether stresses causing or attending it has already become.

Electro-Motive Force of the Electric Fish—In the Proceedings of the Royal Society, Messrs. F. Gotel and G. J. Burch describe some experiments on the malapterurus, or electric fish from the Nile. The electrical discharges of an excised piece of the electric organ taken from a freshly killed fish were excited artificially by stimuli applied to it through its nerve. The piece experimented upon was 15 millimetres in length, and contained approximately 530 disks. The maximum electro-motive force of the discharge was a little more than 25 volts, thus giving 0.048 volt for each disk or component of the piece examined. By calculating the total number of the disks in the entire organ of the fish it is estimated that the electro-motive force of a discharge of the whole is about 200 volts; but as the fish was artificially cooled to five degrees for the experiments, it is believed that the maximum discharge at more normal temperatures would be higher than this. The shocks felt by one of the experimenters during the dissection of the fish support his measurements of the electro-motive force. The low figure of 17 volts for the whole organ, as given by d'Arsonval, was probably obtained by the employment of an unsuitable method of measurement. The resistance of the electrical organ when measured across the disks was two or three times as great as the resistance measured in a direction parallel to the disk surfaces. In each case the resistances were independent of the direction of the current between the electrodes. The measurements of electro-motive force were taken by an electrometer and a moving photographic plate.

Sparking at Alternating-Current Switches—An article by Herr Von Ludwig Kallir, abstracted in the *Elektrotechnische Zeitschrift,* tells us something about the sparking phenomena which occur between the two metallic terminals of a switch upon pulling it out of an alternating-current circuit. The sparking which occurs upon breaking a circuit fed with alternating currents is notably of shorter duration than that which takes place when breaking a continuous-current circuit. According to Arons, the formation of an alternating-current arc between two metallic electrodes is impossible, even if the electrodes be slowly drawn asunder and previously heated. In order to learn more about the sparking phenomena in question, the author photographed the sparks on a plate moving at a known velocity, says the London *Electrical Engineer.* The contacts of the switch employed were of platinum or copper and mercury respectively, the cup containing the mercury being lowered at a known speed. The experiments showed that under ordinary conditions the spark is maintained only for a half period, but under conditions particularly favorable to sparking (high electro-motive force, large current, slow breaking of the circuit) the spark continued for more than a half period, in many cases for 9 to 11 periods. The longer maintained spark appears on the negative as a uni-directed current wave; it is not an alternating spark, but an intermittent direct-current spark. The spark, however, behaved otherwise in a vacuum, where it occurred at half periods in both directions. This may be attributed, the author thinks, either to the absence of oxygen or to the decreased pressure.

RECENT ELECTRICAL PATENTS

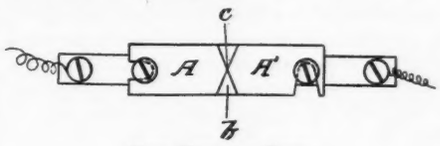
An interesting invention lately patented is a commutator cleaner, the invention of August H. Jahn, of Homestead, Pa. The device is especially intended for use on motor cars, and obviates the necessity of removing the motors for the purpose of cleaning. The machine comprises a cleaner block which conforms to the shape of the commutator and is connected by suitable levers, with the core of a solenoid. The machine is adapted to be supported upon the car contiguous to the motor, the cleaner block being normally held from contact with the commutator by means of springs. The solenoid is placed in a suit-



COMMUTATOR CLEANER.

able operating circuit which has a switch arranged where it may be easily accessible. When it is desired to clean the commutator, the solenoid circuit is closed, while the car is running. The core will therefore operate through the levers upon the cleaner block or shoe which will be pressed into contact with the commutator and will not only clean the dirt therefrom but also keep it properly trued.

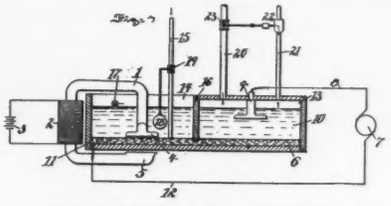
Francis A. Coté, of Ottawa, Canada, has invented and recently patented a novel electrical fuse or current arrester which consists of one or more layers of leaf metal applied to a non-conducting material and inserted in the circuit. In constructing the device the inventor applies gold leaf to an insulating material—by preference a sheet of smooth cardboard—by printing or embossing it thereon with dies made in the required form. The fuse point is made as short as possible in order to reduce the resistance, and when it is desired to minimize this, the fuse point may also be made thinner than the body of the fuse by applying only one or two layers at that point, while the rest of the fuse is made up of two or three layers. The fuse point or link may be slightly sunk into the insulating material with a view



NEW TYPE OF FUSE.

of protecting it from being scratched or broken. The cardboard or other material upon which the gold leaf is printed or embossed can be set by binding or thumb screws, and be inserted in the circuit in the ordinary way. The inventor claims that by this simple construction he has provided an arrester that is exceedingly reliable and exact, and one that offers very little resistance.

A method of producing caustic soda and like alkali by electrolysis has been invented and patented by Justus Entz, of Philadelphia, Pa., who has assigned his entire right to the American Alkali Company, of New Jersey. In processes of this kind the usual method is to deposit the alkali upon mercury by means of an electric current passed through the same. To recover the substance it has been customary to agitate the mercury by a mechanical apparatus which represents many drawbacks to successful operation. The gist of this invention resides in obviating this mechanical agitation, and consists in subjecting the mercury, which is permeated by electric current, to the influence



ELECTROLYTIC CAUSTIC PROCESS.

of a magnetic field which causes it to circulate continuously and transfer the substance deposited in it.

OBITUARY.

John M. Pendleton, at one time active in electrical circles, died at his Staten Island home, of paralysis, on August 18. Mr. Pendleton was one of the officers of the New York Electrical Society, and engaged, at one time, in a number of electrical enterprises. He was a pioneer in storage battery work. Mr. Pendleton was 66 years of age, and leaves quite an estate. His fortune was made in the wool trade during the Civil War. He was connected with numerous enterprises on Staten Island.

TELEPHONE AND TELEGRAPH

The New York Telephone Company is preparing to erect a modern four-story, fireproof exchange building in Mt. Vernon, N. Y. The cost of the building will be about $40,000.

At the last meeting of the Home Telephone Company, of Cortland, N. Y., the contract for constructing the line was given to the Central Construction Company, of Wisconsin. The work of setting the poles, stringing the wires and locating the instruments must be completed by September 10.

At a meeting of the mayor and council of Macon, Ga., recently, an ordinance was passed granting to A. Bisbee & Company the right to construct a telephone system in Macon in accordance with a contract to be drawn up by the city attorney. One of the conditions of the contract will be that the company must give a bond of $25,000 that it will not sell to any other competing telephone company. The new company proposes to give a much cheaper service than the Southern Bell Telephone Company is now giving.

It is said that the sub-companies of the Erie Telephone system increased their net earnings over 41 per cent for the six months ending June 30 over the corresponding six months of last year. The gross income for the year 1900 will exceed $5,000,000, as compared with $3,600,000 for the year 1899. The Erie's proportion of the net earnings is at the rate of 9 per cent on the capital employed, and will average for the year the same as last year, namely, 10 per cent, after deducting all interest and fixed charges.

All the telephone companies in California, Oregon, Washington, Nevada, Idaho and Arizona have been consolidated, the new corporation being the Pacific States Telephone and Telegraph Company. It is capitalized at $15,000,000. Of this, $10,000,000 has been issued to stockholders in the old corporations, and $5,000,000 has been held in trust to provide for future extension and improvements. The companies entering the combine are the Sunset Telephone and Telegraph Company, Pacific Telephone and Telegraph Company, The Oregon Telephone and Telegraph Company and Inland Telephone and Telegraph Company. This does not mean that any opposition companies are bought out, for all four of the combination companies are licensees of the American Bell Telephone Company, and have hitherto been affiliated.

American Electro-Therapeutic Association.

The tenth annual meeting of the American Electro-Therapeutic Association will be held at the Academy of Medicine, 17 West Forty-third street, New York city, September 25 to 27 inclusive. Members of the medical and electrical professions are invited to attend without further notice. Dr. Walter H. White, of Boston, is president, and Dr. George E, Bill, of Harrisburg, Pa., is secretary of the association. Dr. Robert Newman, of 148 West Seventy-third street, New York city, is chairman of the committee on arrangements, and can furnish information regarding the meeting. The headquarters of the association during the meeting will be the Hotel Bristol, at the corner of Fifth avenue and Forty-second street. The programme includes reports of standing committees, a large number of papers on the use of electricity in medicine, and discussions on topical subjects. A number of entertainments have been planned, including visits to various prominent electrical installations in New York, as well as to hospitals and other points of interest to the profession, and carriage drives and trips of various kinds.

Association of Edison Illuminating Companies.

As already announced in the ELECTRICAL REVIEW, the next convention of the Association of Edison Illuminating Companies will be held at the Grand Union Hotel, Saratoga Springs, N. Y., on Tuesday, Wednesday and Thursday, September 4, 5 and 6. It is understood that an excellent programme has been prepared and that the convention will be a most successful one. The present officers of the association are: President, John W. Lieb, Jr., of New York city; vice-president, William Chandler, of Sault Ste. Marie, Mich.; treasurer, W. S. Barstow, of Brooklyn, N. Y., and secretary, Wilson S. Howell, of Newark, N. J. The secretary's mail address is P. O. Box 114, Newark, N. J. The executive committee of the association is formed of the officers and Alex Dow, of Detroit; Charles L. Edgar, of Boston; Samuel Insull, of Chicago; W. H. Johnson, of Philadelphia, and George R. Stetson, of New Bedford, Mass.

At the recent annual stockholders' meeting of the Boston Electric Light Company, the directors were reelected with the exception that Isaac T. Burr succeeds Dexter N. Richards. Samuel S. Sias was reelected treasurer and clerk.

Electric Motors for Direct Coupling to Printing Machinery.

Nowhere has the electric motor made a better showing or contributed more considerably to the success of a mechanical operation than it has in its application to printing presses and other machinery used in the arts of printing, book binding, type setting and the various branches of the "art preservative."

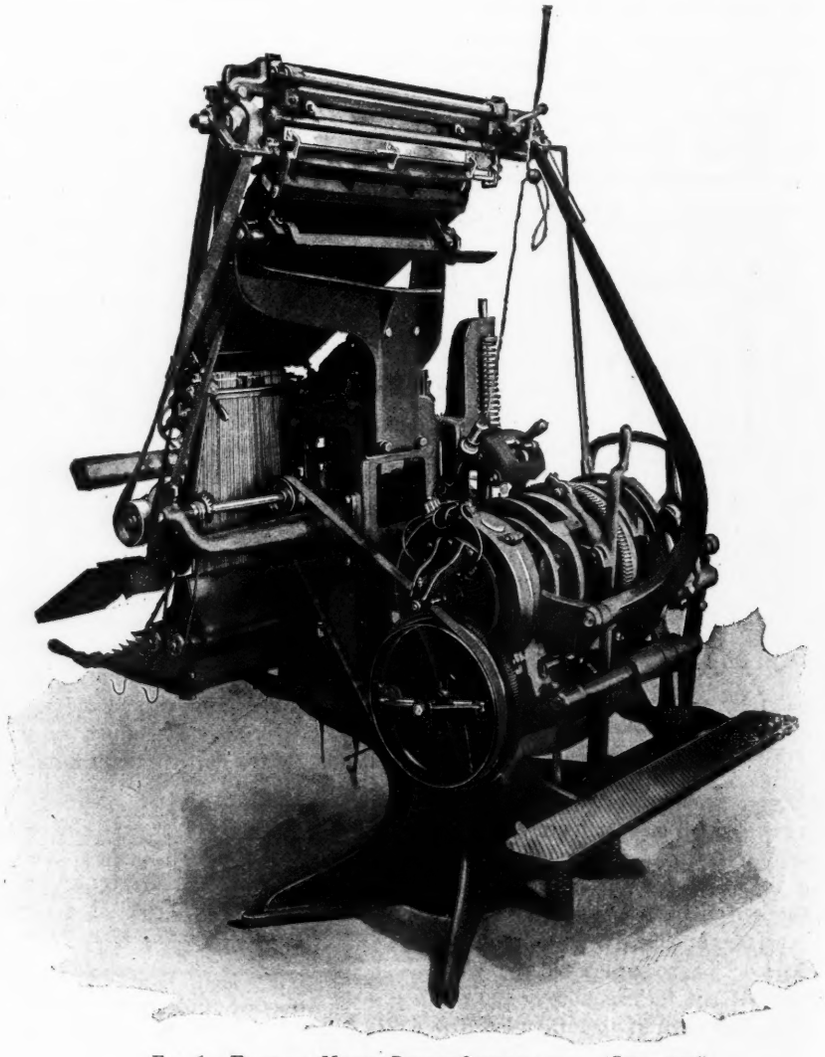


FIG. 1.—ELECTRIC MOTOR DIRECT-COUPLED TO A 'LINOTYPE" TYPESETTING MACHINE.

About the middle of the fifteenth century it was thought wonderful that Gutenberg was able to make 300 impressions a day by hard work with his hand press; 25,000 copies an hour of a large newspaper, printed, folded and pasted, is nothing extraordinary in these days. The Lundell motor, manufactured by the Sprague Electric Company, has been adapted especially for this variety of work. Fig. 2 opposite represents a motor of this type direct coupled to a printing press, with an automatic feeder attachment by which the services of a feeder are dispensed with. The illustration speaks for itself, showing all parts of the apparatus with great clearness. Fig. 1 shows a Lundell motor geared to a Mergenthaler linotype machine. It will be noticed that the latter machine is entirely self-contained, having no connections with any belting or shafting, and being fed by the small, flexible cable which supplies its electricity, and a gas pipe on the other side for keeping hot the pot of metal from which the lines of type are cast.

The Minneapolis, Minn., General Electric Company reports June gross earnings of $20,675, compared with earnings of $18,299 in June, 1899. The addition to the company's water-power plant will be completed very shortly and the increase in water-power capacity is expected to produce a material decrease in operating expenses.

Our Cousin from Across——

[*From the London Electrical Review.*]

Before this time next week many of our American cousins will be among us, and collectively and individually a hearty reception will await them. It is their due. They have led the race of progress throughout the century, so far as applied electricity is concerned. Let us see. There is no necessity to enter into detail as regards dates and particulars; the broad facts must suffice. Notwithstanding the fear of Mr. Fahie's historic accuracy, there is no doubt the world of telegraphy owes much to Morse. He gave a much needed fillip to the application; in a way, in fact, made it practical. Then Henry, so long forgotten, is now acknowledged to have been a pioneer discoverer in things magnetic. Come we to the telephone. Thick-headed, conservative, muddle-through-it-somehow John Bull did all he could by means of the men in authority and subjugated by red-tape to stop the introduction of one of the grandest and greatest of the discoveries in electricity. Talk about driving a joke into a Scotchman's head by the aid of a sledge-hammer; telephony has been driven into England's industries by the skill, energy and pluck of our American brethren, who believed in it, and the converts their push obtained here. There is not a single paragraph in the history of telephony that redounds to the credit of England. True, the man who made it practical—the late Professor Hughes—was long a resident among us and beloved by all, but even his great services, gratuitous to the world as they were, would not have aided much in the development of the industry had it not been for the business men who took the work in hand. Be it far from us to say that there was no foresight among the permanent officials here. To our own knowledge there was plenty, because in the earliest of early days we discussed the whole subject with the then scientific chief. The stumbling block was elsewhere. "Move on," says the policeman, and we move on. Who, we ask, introduced electrical energy for lighting purposes? In England we played with it. Our manufacturers manufactured in driblets. Neither manufacturers nor moneyed interests tackled the question as a whole. Edison blundered along, consumed with the idea that electric lighting was not for the unit, but for the multitude. He studied the installation as a whole, not as a fortuitous concatenation of parts brought from various sources and having no earthly connection the one with the other. We do not agree with the bombast of his coadjutors, but Edison gave us the thing as a whole, each part designed to fulfill its function; and from his first installation the industry really started, has grown and developed, till, like the sparrow, it has made a home throughout the civilized world. Shall we proceed, and discuss power distribution and traction? Who will be found ready to take up the battle gage for England in this development as against America? What we have done is not pioneering work; it is simply the weight of circumstances and national characteristics that compel the pioneers to build and equip their factories here. From a national point of view this is a distinct gain, but it detracts nothing from the fact that someone else had to show us the way, to produce the "go," and generally to direct our eyes and our feet in the way they should go. Many of the men who have assisted in our learning, who, in fact, have been teachers, are passing through our homeland to visit Paris. After all, they are scions of our own race, they are brothers in blood—younger as a nation; and, as is usual with the young, pushing, energetic, ambitious. They look upon England as the centre of their race, and shall we fail them in their just reward—a due appreciation of the works they have done? The very thought of backwardness is a libel upon the temperament of John Bull. His heart is still in the right place, and he will show that it is so by giving a most cordial and hearty welcome to the members of the institute from across the sea.

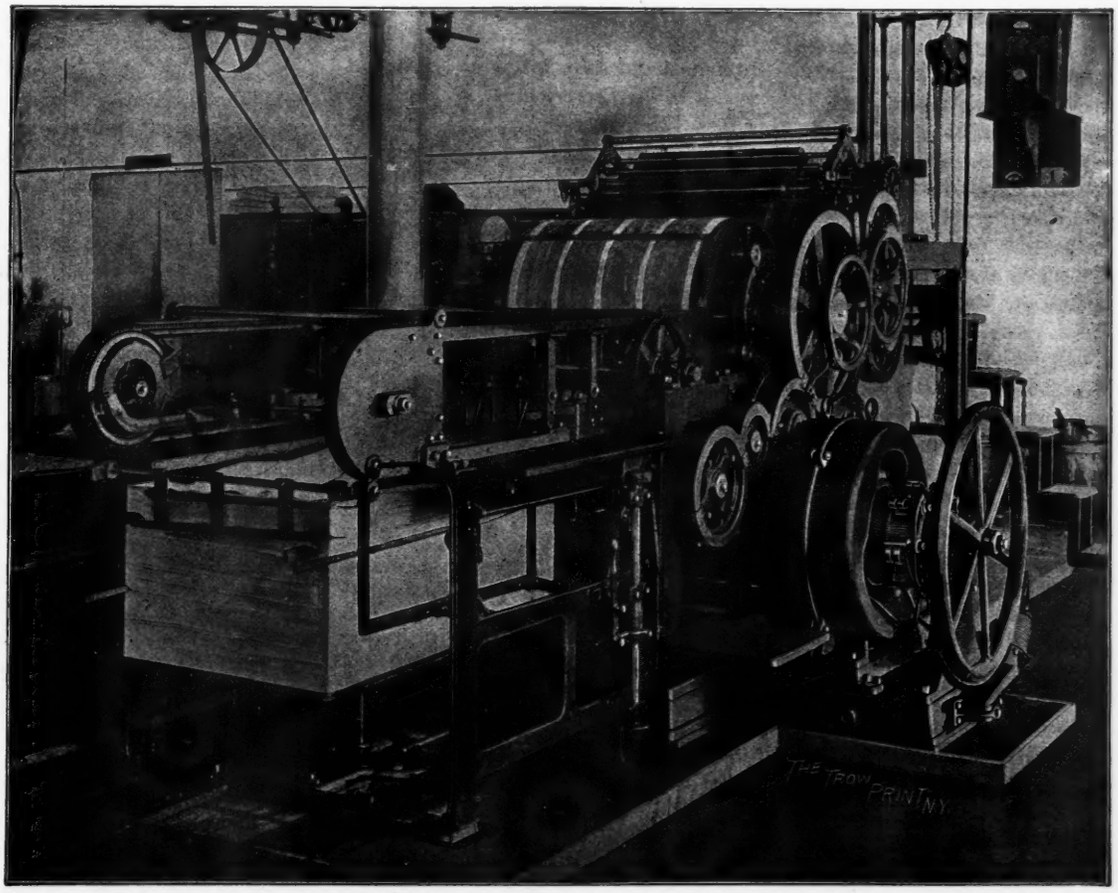


FIG. 2.—ELECTRIC MOTOR DIRECT-COUPLED TO PRINTING PRESS.

Wall Street and the Electrical Stock Market.

The market showed a gradual steady improvement throughout the week up to Thursday, when a reactionary tendency developed and which made further progress to the close of the week. During the early part of the week there was a substantial increase in outside interests and a wholesome distribution of speculation. On Thursday, however, without any change in the circumstances really governing the case, the rise in the market ceased and trading lost its confident tone. The market closed with interest centered chiefly in Brooklyn Rapid Transit, whose annual report had been made public the previous day.

On the New York Stock Exchange, General Electric closed the week at 136 bid and 138 asked, a gain of 4½ points for the week, and 6½ points for two weeks. An officer of the company said: "I understand our stock is very strong, but there is no reason for it beyond the fact that our business is very satisfactory." Metropolitan Street Railway, of New York, closed at 154½ bid and 155 asked, a gain of 1 point in the bid price for the week. Third Avenue Railroad closed at 110⅜ bid and 112 asked, a gain of 1 point for the week. Brooklyn Rapid Transit closed at 57¼ bid and 57½ asked, a loss of ⅜ point for the week. As noted above, this company's report for the year ended June 30, 1900, was made public on Friday. People interested in the stock market had awaited with interest the publication of this report, which, however, was not given to the daily press until long after the stock exchange was closed; hence the interest shown in the stock Saturday. On Friday the stock was strong, selling as high as 59¼. The reported surplus for this year's operation is $526,772, which is about 1.17 per cent applicable to dividends on the company's $45,000,000 of stock. The general expectation had been that the stock would show something more than a 1 per cent dividend. The operating expenses of the road, as shown in the report, were about 66 per cent of the gross earnings, which is regarded as high. Another point of interest in the statement is that the company has, during the past year, borrowed $1,000,000, and has paid out in damages, during the past 12 months, $797,000. Manhattan Railway, of New York, closed at 91½ bid and 91⅞ asked, a gain of 1⅛ points for the week.

On the Boston exchange, American Telephone closed at 142 bid and 143 asked. Erie Telephone closed at 96 bid and 97 asked, a loss of 1 point for the week. New England Telephone was not quoted.

On the Philadelphia exchange, Electric Storage Battery closed at 73 bid and no asked price. Union Traction closed at 37 bid and 37¼ asked, a gain of ¼ point for the week. Electric Company of America closed at 9⅛ bid and 9⅜ asked, a gain of ⅜ point for the week.

On the curb, or outside market, in New York, Electric Vehicle closed at 16 bid and 19 asked, a loss of 3 points for the week. Electric Boat closed at 13 bid and 16 asked, a loss of 2 points for the week.

Wall street, August 18.

International Association of Municipal Electricians.

The International Association of Municipal Electricians, through Captain William Brophy, president, and Morris W. Mead, chairman of the executive committee, has issued a circular containing full information regarding the fifth annual convention of the association, to be held at Pittsburgh, on September 25, 26 and 27. The circular is in the form of a cloth-bound booklet and is an unusually elaborate announcement. The following papers are on the programme to be read and discussed:

"Benefits to be Derived from Our Association," Captain William Brophy, chief electrician wire department, Boston ,Mass.

"Contact Points," by Frank C. Mason, superintendent of police telegraph, Brooklyn, N. Y.

"Trials and Troubles of Instituting and Enforcing Municipal Inspection and Control," M. G. Canfield, superintendent fire alarm telegraph, Grand Rapids, Mich.

"Automatic Fire Alarm Systems," Charles Burger, manager Boston Thermostatic and Automatic Fire Alarm Company, Boston.

"Advantages and Disadvantages of Carrying High and Low Potential Conductors upon the Same Poles." The name of the author of this paper has not yet been announced.

The headquarters of the association will be at the Monongahela, where the sessions of the convention will be held in the banquet hall. There will be two sessions daily; one at 9.30 A. M., and the other at 2.30 P. M. Numerous entertainments have been provided by a local committee, and the principal manufacturing plants of Pittsburgh, including those of the Westinghouse Electric and Manufacturing Company and the Standard Underground Cable Company, will be visited.

The booklet mentioned above contains a great deal of information valuable to electrical men regarding Pittsburgh and its vicinity. It is worthy of preservation and its designers are to be congratulated on the completeness of their work.

The Longest Third-Rail Line in the World.

The Albany & Hudson Railway and Power Company is about to put in operation its line running from Albany to the city of Hudson, N. Y., a distance of 38 miles, which has been, in part, newly built and in part changed over from a steam railway system to a third-rail electric line.

The line contains several heavy grades, but, in the main, is built on steam railroad standards. It is equipped with heavy T-rails and is ballasted and aligned for high-speed running. Current is generated at a plant at Stuyvesant Falls, on the Kinderhook Creek. The dynamos generate current at 12,000 volts and it is transmitted to a number of sub-stations along the line, where it is transformed and converted to direct current at 550 volts. The total cost of the line is about $2,500,000. It opens up a large and fertile section of farming country, which is also highly picturesque, views of the Catskills and the Berkshire Hills existing at many points on the line. It is expected that a large freight business will be done in connection with the numerous manufacturing industries in the region traversed as well as in dairy and farm products, while a large passenger business is also anticipated. The officers of the road are: A. M. Young, of New York, president; Maurice Hoopes, general manager; Ernest Gonzenbach, chief electrical engineer, and Thomas Cochrane, chief of the right-of-way department.

Paris Gold Medal for an American Mica Maker.

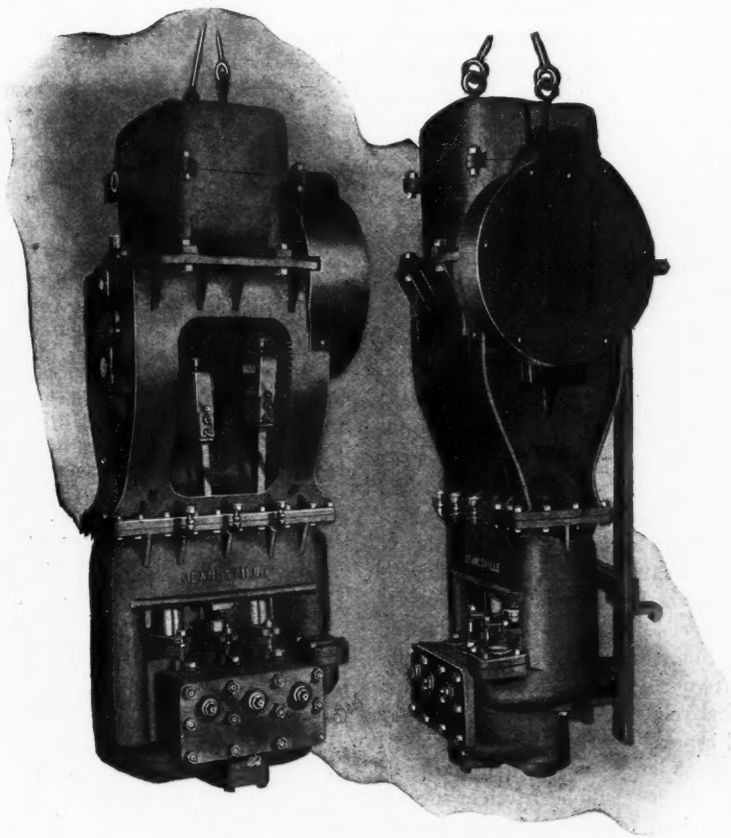
The Mica Insulator Company, of New York city, informs the ELECTRICAL REVIEW that it has been awarded a gold medal at the Paris Exposition. The company's exhibit was very complete and unique and contained a great many specimens of mica as well as micanite, which it also manufactures. This, in connection with the fact that the Mica Insulator Company is the original inventor and patentee of micanite, was the reason the gold medal was awarded to it.

Pittsburgh Reduction Company's Works not Badly Damaged.

The reports sent out by telegraph from Pittsburgh concerning the damage to the Pittsburgh Reduction Company's plant for making aluminum, at Kensington, Pa., by a cyclone last week, were much exaggerated. The damage, while considerable, was confined to a portion of the works and caused a delay of only two days before further operations were resumed.

Electric Mine-Sinking Pumps.

There is probably no class of pump that is required to perform its work under conditions so distinctly difficult and trying as the mine-sinking pump. While economy in operation and smoothness in running, are, of course, desirable, the absolutely necessary requirements for a first-class sinking pump may be stated in this order—absolute reliability of operation, capacity for pumping both air and water, small space, lightness, accessibility of working parts, and strength of design and material.



An Electric Mine-Sinking Pump.

The electric sinking pump herewith illustrated is one made by the Jeanesville Iron Works Company, of Jeanesville, Pa. As compared with other forms of sinking pumps it is, of course, evident that the electrically driven pump possesses enormous advantages. It produces no heating effect in the shaft, eliminates the hot and dangerous steam pipe, is highly economical in power consumption, can be operated by current generated at a considerable distance from the workings, and when it is stopped absorbs no energy whatever.

The peculiar features of the design of this pump comprise a triplex pump with three single-acting plungers operated from a single crank shaft with the cranks 120 degrees apart. The resultant action of this form of pump, as is well known, is to produce a continuous and constant stream, thus reducing to a minimum the shock and jar incident to stopping and starting the column of water in a pipe. The water cylinders are cast in one piece and are connected to the guides by metal castings which form on the one side a vacuum chamber and on the other an air chamber. The valves are of the same type as those supplied to the steam sinking-pumps made by the same company, and have been long tested in practice. They are easily accessible through hand-holes in the face of the valve chamber. The plungers are of cast iron, of a peculiarly close-grained type, and are cast on end to secure homogeneous metal; they are bolted to the cross-head guide, which is fitted with adjustable bronze shoes. The acting rods are fitted with adjustable bronze bearings at each end. The crank shaft is of open-hearth steel and is driven by two gears fitted over the disks, forming the outside cheeks of the two end cranks. This is claimed to relieve the shaft of considerable strain and at the same time to economize space, as no extra room is required for the gears. At the same time, their situation inside the main bearings is recorded as an important advantage which those who have had experience with overhung gearing will be likely to appreciate. The gearing itself is machine cut and is designed to give a liberal factor of safety for actual requirements.

The crank shaft gearings are completely enclosed in a cast-iron frame and the parts are accessible for oiling and inspection through a large hand plate. The motor is placed on top of the pump frame, which is made to receive any make of enclosed motor adapted to this kind of work for either direct or polyphase currents.

A Large Turbine Alternator.

The newly-formed Brown-Boveri-Parsons Syndicate has received an order from the Frankfort (Germany) corporation for a 4,000 horse-power, single-phase turbine alternator for the extension of their well-known central station. The present plant in that station consists of four 500-kilowatt units and two 1,000-kilowatt units, while two more 1,000-kilowatt units are being erected. It is interesting to note in this connection that, although a single-phase plant, yet the total capacity of the motors connected to the Frankfort mains exceeds 5,000 horse-power, which is the best possible proof that a properly-proportioned single-phase installation compares favorably with others, even as regards power distribution, says a British contemporary. At all events there is no town in England which can show a motor load approaching that of Frankfort. The fact that the Frankfort Corporation has, acting on the advice of its resident and consulting engineers and on the report made by a committee of eminent engineers, decided to adopt steam-turbines is a proof that these have come to stay, the more so because all the machines installed in the Frankfort central station up to the present were built by the most renowned Continental firms, and are coupled to splendid engines of the latest types.

The turbine alternator which has been ordered will run at a speed of 1,360 revolutions per minute, giving current at a pressure of 3,000 volts. It will be capable of giving its full output of 4,000 horse-power when working on an inductive load having a power factor of 80 per cent. The alternator will be provided with a special winding, by means of which it can be made to generate three-phase current, in which case its output will be 5,000 horse-power. The set will be by far the largest turbine alternator ever made, and, moreover, will rival in power with the largest reciprocating steam engines ever built for direct connection to electrical machines.

THE AUTOMOBILE WAGON FOR HEAVY DUTY.

BY ARTHUR HERSCHMANN.

(*Concluded from page 159.*)

With steam the case is altogether different. The tendency is here, to build a large wagon, since with a steam wagon, the weight of the machinery to be carried does not grow even in an arithmetical ratio to the carrying capacity. One advantage found in the operation of a large steam wagon may not be apparent to the casual observer. In the case of the horse-drawn wagon one has to discriminate in loading it with goods which are to be delivered only on the exact route covered by the wagon, seeing that the daily carrying capacity of a horse is limited, while in the case of a large steam wagon this would be less important, since, as will be shown later, the percentage of operating expense due to the actual cost of propulsion proper is infinitely smaller than in the case of traction with animal power.

When I submitted my first report to the Adams Express Company, to whom I stand in the relation of mechanical engineer, in 1898, on the progress made on motor wagons, it was my opinion that there had been, up to that date, nothing constructed likely to form a suitable substitute for a horse-drawn wagon but a steam-propelled vehicle. President L. C. Weir then remarked that there seemed to be less difficulty in constructing such a wagon to do the work of two horses than to construct a successful substitute for a one-horse wagon, and I believe that the data which I intend to give later on will convince you of the correctness of this opinion.

As regards the construction of steam-propelled wagons we find that in spite of the fact that steam equipment has been known for many generations, and wagon building has been going on for thousands of years, comparative success has only been obtained within the last few years. Messrs. Scotte, Serpollet and De Dion, in France, were the first to revive the movement, but in the last few years more progress was made in England, in which country the best steam wagons, so far, have been produced. Easy riding wagons have been constructed for many years, and boilers, steam connections and engines do not give much trouble on rock-bottom foundations, but when we attempt to locate engine and boiler on a wagon, which latter they have to drive without suffering from the shock of the locomotion on rough roads, new complications arise which are infinitely more important and troublesome than most people believe who have devoted themselves to the study of this subject. We find early attempts to effect this compromise in a steam vehicle built by the Ericssons in England, in 1830, who placed a vertical engine on the rear of their vehicle, and coupled it up with a long, springy connecting rod to the front wheels, which acted as drivers, thereby preventing excessive shock being transmitted from the wheels to the engine.

Wheels in themselves are far more important problems than is generally believed. My opinion is that at the present day no form of rubber tire will give satisfaction on a commercial wagon intended to carry a net load of, say, one ton or more. The rubber tire is not only expensive, but gives poor satisfaction under combined action of great weight and speed. Attempts have been made to retain the desirable features of a rubber tire, protecting the latter with a tire shield of steel, dating back as far as the early '70's, but it would seem that such combinations are just as troublesome to maintain. Steel tires, if properly applied to stiff, wooden wheels, have been proven to stand most severe work, and they afford the advantage of strengthening the wheels very considerably. It is my opinion that well-constructed springs of ample proportions are, alone, the means to lessen the shock to which a wagon wheel is subjected. In the case of dished or cored wheels, which I consider to be best adapted for heavy work, a steel tire is indispensable, since it binds the wheels together and prevents the spokes from being torn out when striking an outer obstruction. There is considerable divergence of opinion as to whether a comparatively narrow tire or a wide tire should be used, whether the wheels should be small or large, and whether the front or hind wheels should be driven or steered. While it is a fact, even in the case of motor-propelled vehicles, that the width of the tires should be smaller on hard roads and greater on soft roads (but not on sandy roads or in snow), I think that in the case of steam wagons the total width of the tires in inches should be at least twice the number of gross tons carried when small wagons are concerned, say of a capacity of two tons of net load; this coefficient of two, to decrease in the case of very heavy wagons to one and even under.

The reasons why small driving wheels seem to be exclusively used on motor wagons are mostly that it is difficult to design large wheels which will stand such severe strains as motor-wagon wheels are subjected to. In this case the spokes of the wheel not only support the load, as in a horse-drawn vehicle, but they are more or less affected by the action of the driving power, and, moreover, there is also a tendency to twist them. With the ideal wagon wheel the power should be applied directly where the wheel touches the ground. In reality we drive onto a spur wheel, or chain wheel, concentric with the wheel, but, of course, of a smaller diameter, and such an arrangement makes it desirable that the wheel should be small. Another reason making small wheels desirable lies in the requirements of the wagon, and the working of a high-speed motor. In other respects it seems to me that a large driving wheel, say of four-foot diameter, will answer much better than a three-foot wheel, such as has been almost exclusively applied to steam wagons, I consider that not only will a four-foot allow of more powerful starting torque, but it will also save the driving gear, seeing that it does not sink in as deep as a small wheel when it passes over a depression in the road.

The argument presented by advocates of the "front-driving" system is that the wagon will steer a straighter course when the wheel strikes an obstruction, for the reason that the front wheels, in striking, tend to run over the obstruction, instead of being forced aside. I have seen such wagons steered behind and in front, and my opinion is that any advantage of front driving is more than outbalanced by the disadvantages introduced in connection with awkward location of the machinery. One of the early steam wagons was driven by all four wheels, and if such driving could be practically effected, I think it would prove an excellent feature of a wagon. There are, roughly speaking, two steering systems used—steering with a fifth-wheel, and, secondly, steering with pivoted axle ends. It would seem that the fifth-wheel steering arrangement is more adapted for heavy work, leaving the wagon axle unbroken. In reality, this system can not be as satisfactorily applied as steering with pivoted axle ends. To effect the steering of heavy wagons, spur gearing of suitable purchase has to be used, or a worm and worm-wheel device. The latter seems to answer in one of the best designed wagons, but I do not consider it as desirable as steering by means of spur gearing, since it locks the gear, and, besides, causes a severer strain on the wagon in case the front wheels strike an obstruction. In rounding a curve the inner wheels necessarily describe a smaller circle than the outer wheels. To make this practicable, the steering device has to be correctly designed, and the two driving wheels have either to be driven by independent motors, or have to be linked together by means of a compensating gear, or, as it is often called, "Jack-in-the-box." It will be found that in a heavy wagon, particularly one using dished wheels, this driving and the arrangement of the compensating gear are rather troublesome, and that there is still great scope for im-

provement in this connection. The transmission gear, forming the link between the rear wheels and the engine, which is almost invariably in front of the driving wheels, I think, can only be reliably effected by means of accurate spur wheels, immersed in an oil bath. With a steam wagon it is not necessary to use any kind of a clutch while running, seeing that the steam engine is a very flexible prime mover. Nevertheless, I think that a speed reduction gear, which can be best provided by means of two sets of spur wheels of varying diameter, one set stationary, the other movable axially on a square shaft, forms a desirable adjunct to the mechanism, to be shifted when the wagon is at rest, so as to increase its traction power, and enable it to negotiate any special hill, or extricate the wagon from a bad position. We can not deny that for many years to come, greasy and hilly roads, or deep snow, will be the greatest difficulties to contend with. I attempted, on a damp day, to take a load of four tons up an incline of about 1 to 20, covered with Belgian blocks, and there was trouble with the drivers racing. The engine was geared 1 to 14, and the wheels were of three-foot diameter; in my opinion, larger and heavier driving wheels and a much lower gear would have taken the wagon up. With the slightest turn of the valve, the engine, without difficulty, started and on account of the poor adhesion and the light machinery, ran away before the inertia of the heavy wagon was overcome.

The next question we have to consider is the boiler and engine, machinery with which you are all thoroughly familiar. Among the steam wagons built so far, one can notice a great variety of boiler designs. The desiderata of a suitable boiler for a motor wagon are that it should be of the greatest safety, of small proportion, quick steaming and economic. In addition, it should be of the simplest possible construction, and free from joints likely to work loose by jarring on the road. Pipe boilers, while perhaps a little safer than shell boilers, carrying little water, are, for the same reason, undesirable for the varying demands made of a wagon boiler. There are other objections to small calibre pipes; are they necessarily exposed to intense heat and liable to burn, and without a large dry tank they will make wet steam. A shell boiler, on the other hand, can be made of ample proportions, and, if well constructed, and watched during its use, should give no apprehensions as to its safety. The water level can be more evenly maintained, and this is a point of some importance. I consider a superheating device an all-round advantage, provided it is correctly applied to the boiler.

In addition to the engine feed pump, there should always be a second steam-driven pump instead of an injector, which latter, when of small proportions has not yet been made to give satisfaction on a wagon.

The firing of a wagon boiler, can be most easily affected by means of an oil burner, and with a steam-governed burner the firing will automatically respond to the requirements. However, in addition to the inherent disadvantages of using oil, it is difficult to maintain the burner in good trim during all kinds of weather, and at this stage of perfection oil burners will "roar" and occasionally give trouble and make smoke. For the latter reasons coal and coke are preferable, besides being cheaper in use. Solid fuel can be conveniently stowed away, around the boiler, which latter is generally fixed in front of the wagon, and, if thus located, the stored fuel acts as a compressible safeguard to the boiler in case of a head collision. In using a shell boiler, it is found convenient to fire through the boiler top, a system originally introduced into steam-wagon practice with the De Dion boiler.

The difficulties with which one has to contend in the use of steam wagons are, that they will occasionally show a little steam, and during a sharp frost it will be found difficult to prevent a pipe from being frozen up. "Blowing-off" will be found annoying, but this nuisance is largely caused by neglect of the driver and suppressible.

However, these are difficulties which will be overcome in time; using a condenser there will be practically no visible exhaust in all weathers.

Condensers, however, are by no means desirable constituents of a motor wagon, and I should rather put up with an occasional cloud of steam than with a permanent shower bath due to leaky pipes and the difficulties in running a condenser. It can be well said that difficulties in connection with smoke have already been overcome.

The engine so far used is in almost every case a compound. If of vertical design it can be located under the driver's seat; while if of horizontal type it can be suspended from the body. In all cases a light and well-designed, quick-revolution engine will answer the purpose if it is fitted with a reversing gear, and means to admit high-pressure steam to the low-pressure cylinder. The cylinder ratio should be larger than with stationary practice, seeing that the pressure used is higher, and that a large, low-pressure cylinder means a powerful starting moment under live steam, and especial care has to be taken to connect the engine to the frame in an efficient manner. A flywheel is sometimes fitted, and then used as a brake wheel, but I deem it unnecessary. As regards the size of the engine I refer to tables appended.

Generally it can be observed that most of the wagons constructed are by far too light to stand the severe strain of their work. As can be seen from the attached tables relating to the running of a steam wagon, their cost of actual propulsion per gross ton is by no means as important an item as, for instance, in an electric vehicle, and one can, therefore, well afford to provide amply for a durable construction. A heavy wagon is just as easy to bring to a standstill as a light wagon, in fact, easier, since it may be fitted with quicker acting brakes, which, on account of their severe action, could not be fitted to a light construction.

The idea seems to prevail among some builders of steam wagons abroad that the driver should also effect repairs of the machinery, and that he should adjust the latter to suit himself. I rather think that this theory is against the economical exploitation of such wagons, more particularly if they are used in numbers.

In the latter case a concern would probably house a number of wagons in a shed at a distance from their centre of work which would be too great to stable horses there. Such a shed would have facilities for firing up, taking aboard of hot water and fuel, dropping grates, cleaning and maintaining, which operations could go on partly from below and without necessarily interfering with the handling of merchandise.

There would be a foreman capable of adjusting the machinery, or of replacing defective parts, and the driver would merely have to be competent to operate the controlling organs and to take care of his boiler. Radical improvements in the storage of electricity or of compressed gases, or relating to explosive engines may yet put the steam wagon in the background; but judging from accomplished facts it is so far the most successful wagon for the economical transportation of heavy loads.

I believe that if the motor wagon is given an unobstructed field and "fair play," it will hold its own and oust the horse-drawn truck in short order. The change must come, and with, perhaps, the exception of the harness-maker, everybody will benefit by it. The main trouble seems that educated engineers have so far had little encouragement given them to develop the motor wagon, and that the confused efforts of amateurs and stock-jobbers have drawn the attention of almost everybody to their work, except that of the transportation community, who had no accurate data before them to judge of the practicability of the motor wagon.

Opinions will, however, soon be decided and converge on certain lines, and this once being the case many a designer will be saved from exerting himself in a wrong direction.

In conclusion I would state that the attached tables contain some information gained during an investigation covering the last two years, and made in the interests of the Adams Express Company.

It is only natural that in being permitted to read this paper before this honorable body I should return my thanks to President L. C. Weir, who, in granting permission, said:

"I have no objection to your giving the results of our investigations in the manner suggested, and believe, after all, the outcome will be beneficial to us, for it will challenge the attention of a body of men who are highly capable of understanding the wants of carriers of merchandise, and when given a description of what has been found by you in our interests in foreign countries, they will have a foundation for thought, out of which will probably come something vastly better than anything yet exploited, and be a credit to Yankee ingenuity."

The Poet of "The Sun" and the Electric Fan.

To the Editor of Electrical Review:

May I offer the following in response to the able and brilliant reply of "Voltabout," in the Electrical Review of August 8, to my feeble remarks in *The Sun* concerning the electric fan:

Gee whiz,
I didd't kdow
Whad I was goig
Up agaisst,
Ad I apologize
To everybody with
A spark of electricity
Id his throbbing bosob.
Why didd't
Subbody pud up
A Sigd
Thad the dabd ode fad
Was loaded
Ad both eds?
I already kdew
Id was loaded
Ad the wud I sad udder.
Of course I kdow
The Electric Fad
Is the fidest thig
Od earth
Id Subber tibe,
Ad thad id is
As harbless
As a dew bord babe
Ad all tibes,
Ad I oughd to have had
Bedder sedse thad
To wride a poeb
Aboud id;
Ad *The Sun*
Shouldd't have pridted id;
Bud sidce the bischief
Has beed dud,
I hope you will pridt
By apology,
So thad *The Sud*
Bay be forgived
If I dever ab.
Just the sabe,
I've god a code,
A dab bad code,
Ad I kdow how
I god id.
See?

Hoping these few lines will find you enjoying the same blessing, I am,

Most cordially,
W. J. Lampton.

New York, August 18.

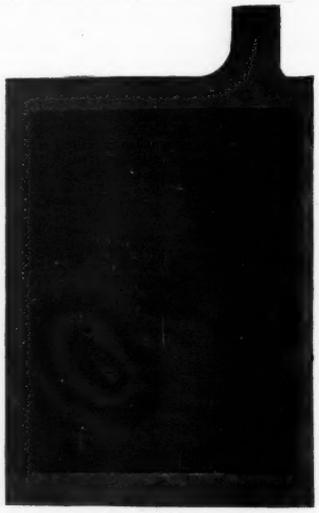
Survived a Shock of 1,100 Volts.

A newspaper despatch from Lowell, Mass., says that H. C. Taft, of that place, survived a shock of 1,100 volts on August 18, and has not experienced any serious results. He was on the roof of a railroad station hunting for a leak, and touched an electric wire from which the insulation had worn off. The roof was covered with copper and was grounded through an iron pipe. The exact kind of current and duration of contact is not mentioned.

A New Electromobile Storage Battery.

The illustration herewith gives an excellent idea of the appearance of a positive plate used in the new type of storage battery for automobile purposes made by the Gould Storage Battery Company, New York. These plates are manufactured by a forming process, by which it is claimed that a large amount of active surface and contact between the supporting material and the active material is obtained, together with large capacity in the plates and great durability in operation. Both the positive and negative plates are formed by an electro-chemical process.

For automobiles, a cell giving 162 ampere hours at a three-hour discharge rate,



Positive Plate of a New Electromobile Storage Battery.

and 180 ampere hours at a four-hour discharge rate, weighs, complete, 50¼ pounds and contains 13 plates, 5⅞ by 7¾ inches in size. The weight of the element alone is 40 pounds, and the normal charging rate 54 amperes. This element is made up in rubber jars with tight covers. The same company also manufactures storage batteries for all purposes to which these elements are applied. A simple and ingenious addition to the stationary type consists of a transparent glass cover, through which the interior of the cell may easily be seen and under which the gases generating in charging may escape, but which prevents the injurious effect of the dust and dirt upon the solution, and condenses and returns the spray and vapor ordinarily escaping when cells are fully charged.

The marriage has been announced, in Germany, of Mr. W. D. Weaver, editor of the *Electrical World and Engineer*, of New York city, to Miss Mildred E. Niebuhr, of Bremen. The Electrical Review extends its congratulations.

AUTOMOBILES

Experiments began in New York city this week in the collection of mail by means of an Oakman automobile. If the experiments prove to be a success it is believed other cities will be benefitted by the trials now making in New York.

The General Automobile Company, capital, $125,000; the General Electric Storage Battery Company, capital, $125,000, and the Munson Safety Automobile Company, capital, $125,000, were incorporated at Trenton, N. J., last week.

Automobile manufacturers are much interested in the suits which the Electric Vehicle Company, of New York city, has brought against the Winton Gasoline Carriage Company and the Buffalo Gasoline Engine Company, claiming infringement on an original patent covering all forms of gasoline carriages. The patent involved is that granted to George B. Selden, on November 5, 1893, and numbered 549,160. The patent was sold by Mr. Selden to the Columbia & Electric Vehicle Company, from whom it was acquired by the Electric Vehicle Company. An association of automobile manufacturers has been formed to defend the suits brought by the Electric Vehicle Company. The president of this association is Mr. Elmer Apperson, of Kokomo, Ind., and the secretary is Mr. George H. Brown, of the Winton Motor Carrige Company, Cleveland, Ohio.

American Electromobiles Win at the Paris Exposition.

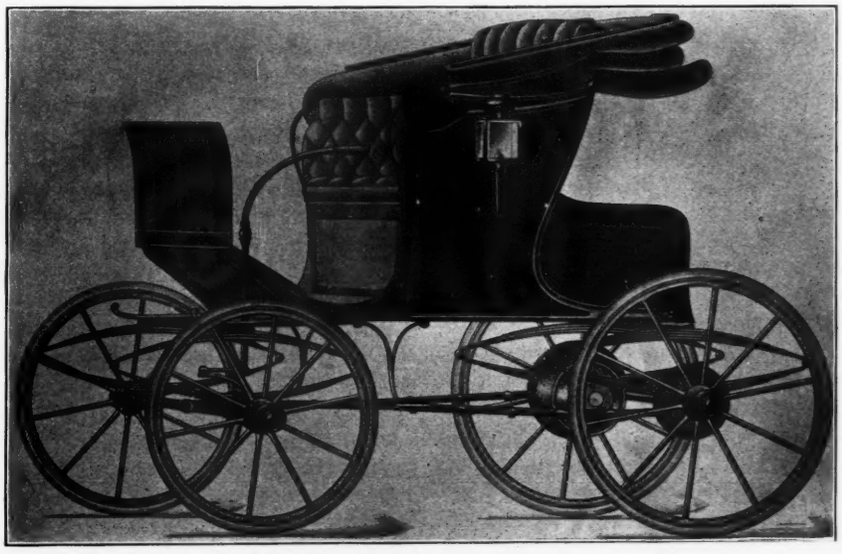
The American Electric Vehicle Company, of New York city, has been informed by cable that its exhibit at the Paris Exposition has been awarded the grand prize and gold medal over all competitors. The award of such a prize at an exposition of this character, especially when it is held at Paris, the home of the automobile, is certainly cause for congratulation, in which the Electrical Review heartily joins. The success of the American Electrical Vehicle Company in this contest is chiefly due to Mr. C. E. Corrigan, the company's general manager, who is well known as a pioneer in the manufacture of electromobiles, and who devoted special efforts to making a comprehensive and representative exhibit at Paris.

Mr. Ralph W. Pope, secretary of the American Institute of Electrical Engineers, who is now in Paris, expects to return to New York city about September 15.

The "Horseless" Look of our Automobiles.

[*From the Chicago Times-Herald.*]

Notwithstanding the rapid development of the automobile the manufacturers and inventors have not yet supplied a self-propelling vehicle of such unique design as to furnish no suggestion of the horse or his absence. Inventive skill appears to have been concentrated in the direction of motor power rather than in the architecture of the vehicles. The automobiles we have thus far are "horseless carriages." Their "horseless" condition is their most noticeable characteristic. They have all the exterior evidence of an abrupt severance of the ties that bound them to the equine type of locomotion.



A NEW ELECTROMOBILE STANHOPE.

The *Times-Herald* put in its plea long ago for an automobile that would invite no lamentations over the passing of Dobbin. Our plea was for an automobile that would be of such original design as would give no suggestion of the horse. But the inventors go right on turning out "horseless" carriages. The wonder is that the shafts and whiffletree have been discarded.

And now comes the ELECTRICAL REVIEW with a plaintive and earnest editorial plea for an automobile that shall look as though it had always been a self-propelling vehicle, had never been hitched to a horse, had never seen a horse and did not know that such a thing as a horse existed. The REVIEW avers that the "Chinese mental attitude" toward innovations appears to have cropped out in our construction of automobiles. It says our "adherence to the old lines of the horse-drawn vehicle would be pathetic were it not so infinitely ridiculous." "If anybody can assign any reason whatever why an automobile should look like a horse vehicle without a horse now is the time for him to speak," says the REVIEW.

But isn't it barely possible that the designers of automobiles have made a study of the public taste in this matter and are endeavoring to conform to it? The public is not ready to give up the horse. It does not want to forget the faithful animal that has carried the burdens of our civilization. It is, therefore, doubtless a fact that the automobile will make greater progress in ingratiating itself in public favor if it retains some visible reminders of the horse. It is highly probable that a very radical departure from the lines of the horse-drawn vehicle would really retard the development of the automobile.

For this reason, no doubt, the "dashboard" style of horseless carriage will prevail for many years to come. In the popular mind an automobile that furnished no suggestions of the horse would not be a "vehicle." The twentieth century automobile, in its ultimate development, however, will contain no more reminders of a horse than a trolley car or a locomotive.

[*From the New York Times.*]

While denying with just a trace of resentment our mild intimation that the ELECTRICAL REVIEW would be more profitably employed in suggesting a better form for automobiles than it was in denouncing the "Chinese" conservatism of those who are making machines that look "like a horse vehicle without a horse," our not less esteemed than scientific contemporary frankly admits that it will be no easy task to design a type of self-propelled carriage that shall be at once convenient, beautiful, and free from the artistic faults of mimicry and concealment of structural facts. After recalling the length of time it took the builders of railway cars to forget the peculiarities of stage coaches, and after calling attention to the circumstance that the trolley car is still only a magnified and glorified street car, the ELECTRICAL REVIEW expresses the confident belief that some day a stroke of genius or the slower method of evolution will give us an automobile that does not seem incomplete without a horse in front of it. "The man who undertakes to make the design," we are told, "must absolutely lay aside preconceived ideas and prejudices. He must forget carriages and vehicles of all sorts, and, starting from the few simple data necessary, must devise a structure fitted to its purpose and beautiful to the eye. For this man there is much chance of reward." No doubt. But, meanwhile, why not regard the present shape of automobiles as fortunate in that it makes them much less likely to alarm horses? Those animals are still numerous enough to make it worth while to take their timidities and prejudices into account. Moreover, is not the critic himself a bit "Chinese" in his inability to see a four-wheeled vehicle of a certain size and shape without conjuring up a horse to go with it? Really, there's no need to do so, and there are lots of people who already have separated the two concepts for good and all.

A New Electromobile Stanhope.

The handsome electric vehicle represented in the engraving herewith is a new type of stanhope built by the Buffalo Electric Carriage Company, Buffalo, N. Y., and claimed to embody several important improvements in construction and operation.

In the design of the frame no tubing is used, but the lines of carriage making are followed in all points except that additional strength is given the running gear in places where this is requisite. The vehicle is fitted with wooden wheels, hard rubber tires, and elastic wooden reaches. It is furnished with ball bearings throughout and is fitted with the Collinge style of axles. The seat is 41 inches wide, or large enough at a pinch for three persons.

Enough accumulators are installed on the vehicle to give it a capacity of about 50 miles on one charge over level roads, though under normal conditions as much as 63 miles have been traversed on a single charge. The battery can be recharged in 45 minutes from a 110-volt source of supply. The vehicle is provided with three speeds forward and one backward, its highest speed being 15 miles an hour.

English vs. American Electric Railway Practice.

The following editorial remarks from our esteemed contemporary, the *Practical Engineer,* of Manchester, England, under the above heading, are of considerable interest, as showing the present-day English point of view regarding American engineering:

During the past few years it has been considered necessary for every English electrical engineer occupying a position of any special importance to become more or less Americanized. We can not open a New York technical journal without finding that one or other of our electrical engineers has been on a brief visit to the States, in order to make himself acquainted with American ways and systems, and deduce therefrom the trend of electro-technical development. Many of these have gone as the representatives of our municipalities, seeking up-to-date knowledge regarding electric tramway practice, while others have been sent on behalf of electrical and tramway equipment manufacturers, anxious to, as far as possible, regulate the character of their future output by the probable requirements. In a few cases, also, engineering firms have sent representatives, and sometimes principals have gone themselves, in order to become thoroughly acquainted with the ins and outs of American works management, to examine into machine tools and machine tool methods, and to place orders for similar tool equipments in substitution of old machines which have done comparatively inefficient service for some time.

English engineering, and electrical engineering in particular, has been benefited by the reports made upon such investigations. In the case of manufacturers who undertook the cost of such expeditions in order to benefit themselves in their own individual businesses, these reports have, quite naturally, not been thrown out in the open, so that rival manufacturers can obtain the fruits of the labors of others by adopting the recommendations contained therein. But while it may be possible to keep things of this kind to one's self at the time, it gets noised abroad, sooner or later, that such and such a firm is doing so-and-so; of course, in the meantime, the enterprising manufacturer has got the pull over his contemporaries, and the benefit is calculated to be lasting rather than temporary. To be enterprising too late in the day is tantamount to not being enterprising at all, and there may perpetually be a certain headway to make up if ever there is to be any approach to getting into line with others.

We suppose that of recent years few facts have been so plainly evident as that English manufacturers needed to put forth a great effort to recover lost ground in electric traction machinery, both in regard to power station equipments and electric cars and other rolling stock. One of the most recent municipal electrical engineers to make a study of this subject is Mr. Le Rossignol, who is the tramways engineer to the Newcastle-on-Tyne Corporation. The impressions formed by him on the occasion of a recent visit to the States were outlined by him very briefly before the Municipal Electrical Association, at Huddersfield. Tramway promoters over there appear, from what he says, to have things very much their own way—a very different state of affairs from that prevailing in this country, where municipal opposition exists at every turn. The American promoter finds it far easier to obtain powers to extend his lines, and is permitted to run his cars at a rate of speed much higher than is allowed here. These are points which a tramway engineer fully appreciates. It seems that the present tendency—or even "fashion"—in tramway construction in America leans towards the erection of a large central station, with high-pressure distribution to sub-stations. Those companies which are hampered with a number of low-tension power stations do not, however, admit that their economical results are very greatly inferior, if at all, to those attained as yet by the larger single systems; and in many cases they are providing for additional extensions by adopting battery sub-stations, with charging mains to those fed by boosters. Coal-handling and storing machinery is in almost universal adoption in the States, and this keeps the fuel costs remarkably low. While it can not be said that "almost universal" is their use over here, it should be mentioned that in all recently-designed power stations in England, the coal-handling facilities are of the most up-to-date character. As evidence of this one might quote the Dublin, London United, Bristol, and Middlesbrough tramway power houses, the Central London Railway generating station at Shepherd's Bush, the new power house of the City & South London Railway, and about half a dozen of the larger electric lighting stations in London and the provinces. Central station practice in America tends to the introduction of very large steam power units, and we are following suit in England; but in America these are all of the open, slow-moving type, and so require a larger amount of attendance than would the same size units if enclosed and provided with automatic lubrication, such as have been largely adopted in this country.

A system of mechanical oil supply has been adopted for these large open engines, but Mr. Le Rossignol suggests that if the enclosed type were made as strong in proportion and as reliable in operation as the larger open type, increased economy in labor would be obtained. No doubt English manufacturers will shortly awaken to this fact.

Direct-current traction work involves heavy strains, and, as a result, American steam units have gradually grown to huge proportions of the strain-bearing part, the shaft, and the same proportioned engines are being installed in the three-phase plants, although it is considered that the strains probable in alternate-current work will be very much less. The use of large steam units has led to the necessity for the boiler floor space being reduced, and in America this is done by erecting two or more boiler floors one above the other, surmounted by huge coal bunkers at the top. After some notes on switching apparatus and other matters. Mr. Le Rossignol stated that transformers in America are mostly of the air-blast cooled type, and have the low-tension side directly connected, without switches to their rotaries. If over-compounding is avoided, there is no trouble from overloading. Compounding for a level voltage is provided for by the introduction of self-induction in the high-tension feeders and a series winding on the direct current of the rotary. American companies do not trouble themselves unduly about the return current unless they find too much pressure is lost from the return circuit. The current finds its way back to the station by the rails and supplementary cables, no return-current boosters being used, as in this country. Overhead wire work in America is inferior to English, both in strength and neatness.

Rubber.

Rubber trees in a plantation are planted from 12 to 15 feet apart, and grow to a height of from 40 to 50 feet. At six years of age they are tapped, and yield, at that time, an average of two pounds of rubber per tree, the amount increasing with each year. A tree lasts from 25 to 40 years, giving rubber milk during the whole of this time. It is claimed that the average in profit on rubber growing is from $300 to $500 per acre.

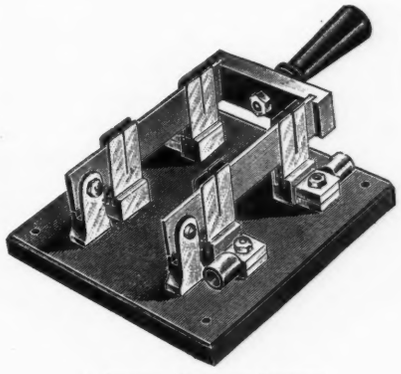
The Great Copper Mines of the United States.

[*From the New York Sun.*]

For the past 18 months copper has enjoyed uninterrupted and unusual prosperity. During that period the market has kept at, or above, 16 cents a pound for lake ingot. In January, 1899, it advanced from 13¼ to 17, and has since sold as high as 19¼, but is at present 16½. Ten years ago, it got as high as 17¼, but until the recent upward movement began the market had not reached similar high figures since 1890. In 1894 prices dropped to 9 cents, and during the whole year failed to advance above 10¼. Along through 1895, 1896 and 1897 efforts to raise values above 12¼ were unsuccessful. At the end of 1898 business began to expand, and the great copper boom was set in motion. Production and consumption entered into competition to beat each other, and for a considerable time the race was close and exciting, and even yet the two are so nearly abreast that interest continues as to which will ultimately lead.

During the 12 months ending on June 30, 1900, the total United States production of copper, by mines whose figures of output are obtainable and other outside sources, amounted to 609,943,040 pounds fine. Within the same period the market price of Lake Superior copper ranged from 16 to 18¾ cents a pound. Allowing some latitude and the usual differences for the mixed grades constituting the above-mentioned production, and figuring the entire output at an average of 16½ cents a pound, the product of the past 12 months would show an aggregate valuation of $100,640,601, which compares with $61,660,248, as the estimated value of the domestic copper production for 1898. Notwithstanding this enormous production, there is comparatively little copper available for immediate use in the hands of either the producer or consumer. In fact, several of the producers are unable to make any contracts for delivery earlier than 30 days, and it is doubtful if some of the mines could fill orders before September.

Although copper is in such abundant supply in this country, the immense demand absorbs it all. The successful mining of copper is confined to certain localities, and the bulk of the metal comes from a few mines. The great copper-producing districts are Montana, Michigan and Arizona, and from these three centres all but a small part of the entire American copper supply is derived. Utah is coming into prominence as a copper producer, and it is there that the promising Highland Boy and the Bingham properties are. Lake Superior has been in the field for more than 50 years as a copper producer for commercial purposes, and less than 20 years ago furnished fully three-quarters of the home output. At present not much more than about 30 per cent of the domestic production comes from Michigan. Since 1880 Montana and Arizona have become famous for their copper mines, where practically inexhaustable deposits of ore have been found. The original owners obtained many of these now widely-known properties for a comparative pittance and have since become immensely wealthy. Millions of profits have not only been taken out of these copper mines, but vast sums have been expended in securing the best mining machinery and for development work on a large scale. In many cases the expenditures are returned with prodigious interest, while the properties are made models of magnificently equipped mines prepared to accomplish even better results than ever before.



A Simple Type of Switch.

Among the oldest and most prosperous American copper mines is the Calumet & Hecla, at Lake Superior, with shaft penetrations of over 5,000 feet on the incline and 4,900 feet vertical depth. It began operations about 33 years ago, and, during its remarkably successful career, has paid in dividends to date $68,850,000 on a paid in capital of $1,200,000. It is the largest producer of lake copper and next to the largest copper mine in the country, the Anaconda holding first place in respect to the size of the product. During the last fiscal year, ending April 30, 1900, the Calumet & Hecla produced 98,624,000 pounds of refined copper. The quantity mined, however, only amounted to the equivalent of 89,096,000 pounds of refined copper, and the balance was supplemented by drawing on the stock of mineral which the company habitually keeps in reserve. Dividends paid during the past fiscal year were $8,000,000, and, after unusual heavy expenses, the company carried over a balance, on April 30, 1900, of $4,260,858. This company is one of the cheapest producers, but expenses were considerably increased last year. Expenditures for machinery alone were equivalent to more than one and one-half cents a pound on the quantity mined. The amount realized on its production during the fiscal year must have been in the neighborhood of $17,000,000, and of this amount it is estimated that the net earnings equal fully one-half.

The largest copper district is at Butte, Mont., where 245,602,214 pounds fine were produced in 1899. The Anaconda company is credited with about half this quantity and the Boston & Montana mine with from 70,000,000 to 75,000,000 pounds. The latter company, with a much less output than the Anaconda, earned $707,630 more last year than the Anaconda, or a total of $6,073,150, against the Anaconda's $5,365,520. The Boston & Montana is making more money this year, in all probability, than it did last year, owing to the better prices received for its copper. It is one of the biggest earners in the business and can get its copper alongside of vessels at this port at phenomenally low figures.

Simple Types of Switches.

The illustration represents a design for a double-break, front-connected, two-pole switch of exceedingly neat, simple and substantial construction. The knife parts are made of rolled copper and the crossbar is of hard fibre. These switches are made in many sizes for voltages up to 600 volts, by Messrs. G. E. Linton & Company, of Worcester, Mass., who also manufacture other varieties of electrical apparatus. The illustration shows a front-connected type of switch made up on a black enameled slate base, but the switches are also made with back connections for switchboard use, the general features of the design being similar.

An Important Link in the New York-Philadelphia Trolley Line.

James F. Shaw & Campany, of Boston, Mass., who are arranging to build an electric railway between Trenton and Philadelphia, are pushing their construction plans actively. They expect to have the road completed and running in about a year from this month. This line will probably be an important link in the proposed electric railway connecting New York and Philadelphia.

ELECTRIC RAILWAYS

The electric road between Havre de Grace and Belair, Md., is now said to be an assured fact.

A movement is on foot for an electric line to connect Painesville, Ohio with Ashtabula. Much of the right-of-way has been secured.

The Columbus, Ohio, London & Springfield Road has been granted a temporary franchise from London to the Franklin County Line, and if this is made permanent, that company will probably start the construction of its line from Columbus to London this Fall.

Efforts towards the construction of an electric road from Port Huron, Mich., to Lexington, and ultimately further into the Thumb and to Bay City are still progressing and the right-of-way from the city limits to Lexington is secured. English money is said to be backing the enterprise.

A meeting of the stockholders and board of directors of the Schuylkill Traction Company was held at their office at Girardsville, Pa., recently, when it was decided to increase the preferred stock of the company from $250,000 to $500,000, and to increase the common stock of the company from $750,000 to $1,500,000.

The city council of Oklahoma City, Okla., has passed the ordinance granting the franchise for a street railway to the Oklahoma City Land and Electric Railway Company for the construction of five miles of electric street railway that will be built at once. The contract for three miles of the road has been let and will be completed by February 1, 1901.

The first move in the gigantic electric railway consolidation project, which will connect Shamokin, Pa., with Mahanoy City by trolley, was made by the Schuylkill Traction Company recently, when the directors voted to increase the capital stock to $5,000,000. New lines from Mahanoy Plain to Pottsville, Tamaqua and McAdoo will be built.

A corps of 20 engineers has been started out over the right-of-way of the proposed electric railway between Hicksville, Ohio, and Marion, Ind., passing through Fort Wayne and Huntington. All the franchises for the road have been obtained, and the road will now be pushed to completion, according to the officials of the company.

It is believed that the new electric road projected from Fort Erie to connect with the Niagara Falls, Ont., line to Falls View will seek an entrance into Buffalo, and, by crossing the railway steel arch bridge to Niagara Falls, N. Y., make connections with the projected line of the Niagara Falls Street Railway Company, and thus furnish a feeder to the Gorge road.

The work of constructing the Hervey City, Ill., & Southern Electric Railway has been inaugurated at Hervey City. It is proposed now to make Pana the southern terminal point and eventually build the line to Chicago. A majority of the right-of-way between the local points has already been secured. The line will be so constructed as to permit of freight cars being handled.

The Montville Street Railway Company, which connects the cities of New London and Norwich, Ct., makes the following statement of earnings, from which it appears that the interest charge for the entire year has practically been earned in 10 weeks, from June 5, the opening of the road, to August 12, 1900: Gross receipts, June 5 to August 12, 1900, $19,-500; operating expenses (estimated), $7,-500; net receipts (estimated), $12,000; one year's interest on its $250,000 five per cent bonds, $12,500.

The traction line from Miamisburg, Ohio, to Germantown, it is claimed by the projectors, will be completed by Christmas. The surveys are all made, rights-of-way secured and other details calculated, in most instances, to delay are completed now. Since power will be rented from the Ohio Southern Traction the construction of power houses will not be necessary. Messrs. Christy & Mandelbaum, of that company, are interested in the road, although the controlling interest is held in Miamisburg.

Work on the Sandusky, Bellevue, Monroeville & Norwalk, Ohio, Electric Railway is now under way at Monroeville. The roadbed is to be built of concrete, and it is said to be one of the finest roads in the state. Work on the power house at Monroeville has been commenced, and it is stated that the road will be in operation by November 1. This same company is also prospecting a line south from Norwalk to Shelby, where it will connect with the Mansfield-Shelby Line, in which event it will pass through Plymouth, Ohio.

A charter has been granted to the Shenandoah & Pottsville, Pa., Electric Railway Company, with the capital stock as $125,000. Powell Evans, of Philadelphia, who is one of the financial men at the head of the board of directors of the Schuylkill Traction Company, is the president of the company. The line will begin at Maizeville, where it will connect with the tracks of the Schuylkill Traction Company, and across the mountain to Frackville; thence to Lower St. Clair, where it will follow the line of the Pennsylvania Railroad Company and enter Pottsville from the extreme end of Nichols street.

The stockholders of the Atlantic City, N. J., Passenger Railway Company, in which a number of Philadelphians are interested, has elected officers. The company has rights to build a line on Pacific avenue, across the Meadow Turnpike and through Pleasantville and Absecon, over the shore road. It is stated that sufficient cash is in the treasury now to enable the company to begin building in October. The officers are: William H. Bartlett, president; G. A. Aldrich, vice-president; A. M. Jordan, treasurer; Eli M. Chandler, secretary; G. A. Aldrich, general manager. Directors: G. T. Lippincott, E. J. Petroff, R. J. Powell, of Atlantic City; Thomas F. Durham and Frank Reeder, of Philadelphia.

The promoters of the proposed trolley line from Providence, R. I., to Fall River, Mass., *via* Seekonk and Swansea, expect to enter into direct competition with the steam railroad, it being their intention to make the run from the centre of Providence to the Fall River city hall and return in one and one-half hours. It was generally expected that the road would follow the highway almost entirely, but the present plans provide for the use of not more than three or four miles of the 13 miles of highway between the East Providence and Somerset town lines. The proposed route between East Providence and Somerset is to all intents and purposes a straight line for nine miles. There may, of course, be some obstacles in the way of this layout which may necessitate deviations, but these obstacles as so far developed are very few. The company is buying rights-of-way from the owners of the land through which the road is laid out, and is not having much difficulty in arranging terms. The residents along the line, as a rule, are doing all in their power to help the road along, and the prices asked for land are exorbitant in only a few instances. Where the price asked for the land wanted is considered excessive, the company has, in each instance, a layout which will avoid the land in dispute should such a course be necessary.

Accumulator Cars.

Mr. M. R. Zechlin, in an article in the *Centralblätt fuer Accumulatoren und Elementenkunde,* speaks of the possibility of improving accumulator cars. This, he thinks, can be done in two directions: First, by decreasing the weight of the cars; and, secondly, in the use of ball bearings. By reducing the weight, he states, the tractive resistance would also be diminished, as well as the effect produced by inequalities of the road surfaces on the structure of the cars and accumulators. This economy in weight might be obtained by the judicious employment of tubular construction without detriment to the strength and rigidity of the cars, and by paying greater attention to the dimensions required for a given strength. The weight of the car itself is, Mr. Zechlin points out, of vital importance, as a surplus weight in accumulator of from 20 to 50 per cent of the total has to be carried. This surplus weight, however, insures the necessary adhesion of the car wheels, and therefore the endeavor of the designer should be to produce a car which, together with its complement of accumulators, is of just sufficient weight to secure the requisite adhesion under given conditions with a proper distribution of the weight. Most of the accumulator cars constructed up to the present leave much to be desired in the direction indicated, says the London *Electrical Engineer.* There is apparently little room for the further improvement of the driving motors and control of the same. Neither does there seem any immediate prospect of considerable economy being effected in the weight of accumulators. A further means of improvement also, says Mr. Zechlin, consists in increasing the diameter of the bearing wheels, whereby the tractive resistance of the car may be reduced and other advantages obtained. This does not, however, apply to all forms of motor-propelled vehicles.

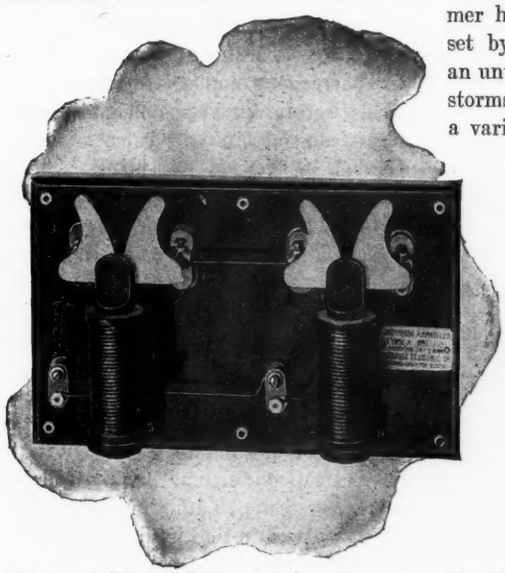


FIG. 1.—A DOUBLE LIGHTNING ARRESTER FOR ARC LIGHT CIRCUITS.

FIG. 2.—INDIVIDUAL ALTERNATING LIGHTNING ARRESTER.

Lightning Arresters.

At this time of the year there is much interest in electric lighting and railway circles in lightning arresters, this Summer having continued the bad precedent set by last Summer and brought forth an unusually destructive crop of lightning storms. The illustrations herewith show a variety of the lightning arrester apparatus manufactured by the General Electric Company, Fig. 1 being a double arrester made for series direct-current arc light circuits. This is intended for circuits of very high voltage containing 75 lamps or more, and consists of two of the well-known magnetic blow-out lightning arresters mounted in series on one base. Fig. 2 is an alternating-current lightning arrester for individual series arc lamps, or for the secondaries of transformers working up to 300 volts. It is enclosed in a compact weatherproof iron box and consists entirely of non-combustible materials. Fig. 3 shows a type of alternating-current lightning arrester as installed in an iron box; the arresting action takes place within the metal cylinders at the upper part of the apparatus which are brought within one-thirty-second of an inch of each other, one being connected with the overhead line and the other to the ground through a low non-inductive graphite resistance. The action of the machine depends upon the cooling effect of the metal cylinders aided by the reversal of the alternating current and the introduction of the non-inductive resistance. Under normal action it is said to show an arc about as large as a pin-head between the cylinders when the lightning shock passes. For 2,000 volts the arrester has two air-gaps. For circuits above 2,000 volts, several of the standard arresters for lower voltages are connected together in series.

Navy Yard Electric Pumping Plant.

The Navy Department, on September 8, at Washington, will open bids for a new electric pumping plant to be erected at the Navy Yard in Brooklyn, N. Y. The appropriation for covering this work is $80,000.

James T. Robb's Address Wanted.

The ELECTRICAL REVIEW is in receipt of some mail addressed to Mr. James T. Robb, whose patent on chandelier switches was illustrated on page 103 of the ELECTRICAL REVIEW for August 1. If Mr. Robb will kindly communicate his address the mail will be forwarded.

Telegraph Line in Germany.

In Germany, the establishment of a new telegraph line between that country and England has been considered, and an addition of $500,000 to the budget has been demanded for this purpose. Since the laying of the fourth cable, in 1896, the number of telegrams has continued to increase, this number being 1,867,868 in 1895, and 2,465,613 in 1899. As a result, the crowding of the lines has been prejudicial to the commercial interests, and, accordingly, the establishment of a fifth line was found necessary. The new cable, of four conductors, will start from Borkum and end at Bacton, Norfolk; it will be constructed and laid in concert with the British telegraph administration, and will unite all the most recent improvements in the technique of submarine cables, says the *Scientific American.* The expense will be supported in common, except for the junction lines proceeding from the terminal stations, which will be borne by the respective governments.

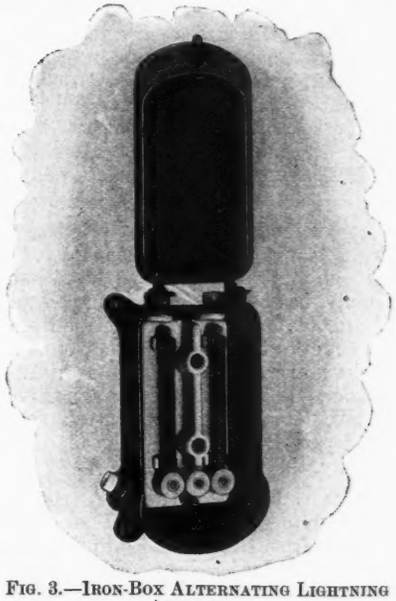


FIG. 3.—IRON-BOX ALTERNATING LIGHTNING ARRESTER

CORPORATION NEWS

MIAMISBURG, OHIO—The Miamisburg, Ohio, & Germantown Traction Company has been incorporated with a capital stock of $50,000. The incorporators are: W. A. Mays, A. F. Gwinner, S. H. Mays, C. W. Dodds and Albert Dwyer.

FRANKLINVILLE, N. Y.—The Franklinville Telephone Company, of Franklinville, has been incorporated to operate a telephone line. Capital, $10,000; incorporators: C. L. Randall, R. S. Litchfield, G. W. G. Ferris, all of Franklinville.

GIRARDVILLE, PA.—A meeting of the stockholders and board of directors of the Schuylkill Traction Company has decided to increase the preferred stock of the company from $250,000 to $500,000, and to increase the common stock of the company from $750,000 to $1,500,000.

RIVERSIDE, N. J.—The American Electrical Amusement Company, of Riverside, has been incorporated with a capital of $1,000,000. It proposes running tramways in public parks and seaside resorts. The incorporators are: George Richards and Paul Morris, of Philadelphia, and Edward Schwabenland, of Riverside.

BINGHAMTON, N. Y.—The Susquehanna Valley Electric Company, to operate in Delaware County, has been incorporated at Albany with a capital of $200,000. Directors are: Henry B. Oakman and Edwin H. Tucker, of Brooklyn; Charles F. Lehman, of Smithtown; C. C. Higgins, of Bedford; L. U. Shopter, of Rockwell Center.

THOMPSON, PA. — The Northeastern Pennsylvania Telephone Company, of the borough of Thompson, Susquehanna County, has been chartered with a capital of $10,000, to construct telephone lines in the counties of Susquehanna, Wayne and Lackawanna. The directors are: A. H. Crozier, S. S. Hubbard, of Thompson; W. W. Mumford, of Starrucca; H. W. Kessler, of Brandt; F. J. Osgood, of Forest City.

GRAND RAPIDS, MICH.—A company has been organized to build an electric railroad from Grand Rapids to Muskegon. James D. Hawks, head of the Detroit, Ypsilanti & Ann Arbor Road, is president, and Wallace Franklin, representative of the Westinghouse Electrical Supply Company, treasurer. All funds are secured for the line, which will cost $1,500,000, and is to be one of the model electric roads of the country. The track will parallel the highways.

NAZARETH, PA.—A charter has been issued at Harrisburg to the Cement Belt Street Railway Company, with a capital of $72,000, to erect 12 miles of street railway, connecting the borough of Nazareth, Christian Springs, Bath and Siegfried, in Northampton County, Pa. The directors are: Thomas A. H. Hay, Howard Mutchler, William O. Hay, Charles L. Hemingway, of Easton; Frank J. Myers, of Petersville; John Blair and Moses George, of Bath.

POTTSVILLE, PA.—A charter has been granted by the State Department, at Harrisburg, to the Shenandoah & Pottsville Electric Railway Company, with a capital stock of $125,000. Powell Evans, of Philadelphia, one of the financial men, and a member of the board of directors of the Schuylkill Traction Company, is the president of the new company. The line of the proposed railway will begin at Maizeville, where it will connect with the line of the Schuylkill Traction Company, and will cross the mountain reaching Frackville, and will run to Lower St. Clair, where it will follow the line of the Pennsylvania Railroad, and enter Pottsville at the upper end of Nichols street.

Electric Railway Development in Pennsylvania.

There has recently been a revival of street railway building in Pennsylvania, as is indicated by the number of incorporations of electric railway companies at the state department. The Venango Traction Company, which will build a line at Franklin, is one of the latest to enter the field. Its line will be eight miles long. Great extensions to the trolley system in Schuylkill County have been planned. A new line is being built between Centralia and Ashland, and another company is at work on a plan to go over the Broad Mountain to Pottsville. Still another company is about to take up a plan to reach Frackville from Pottsville. A new branch will be constructed this year to Middleport, and this will be followed by a connecting link to Tamaqua, which will connect with the railroad from Tamaqua and Summit Hill. Another line is to be built to connect with the Tower City, Williamstown & Lykens system from Westwood through Tremont. It is said these extensions will involve the construction of about 150 miles of railway, and an investment of at least $3,000,000. The Pennsylvania Steel Company has just made a shipment of 900 tons of rails for trolley lines in New York state, and other orders for many hundreds of tons are booked. The trolley road operations in the Cumberland Valley are also active and important. There will be a new line from Carlisle to Mt. Holly Springs, and also between Boiling Springs and Carlisle. This branch will include Churchtown and Mechanicsburg. These connections will give a through trolley line from Harrisburg to Carlisle through a rich and attractive country. The Harrisburg Traction Company will soon extend its Sixth street line to Rockville.

Telegraph and Fire-Alarm Signaling Without Batteries.

The National Magneto-Electric Telegraph Company, an incorporated company, with headquarters at Springfield, Ohio, made some interesting experiments in that city recently. A complete fire-alarm plant was exhibited in the stock room of the Central Union Telephone Company's new building, which was successfully operated without the aid of any battery. This outfit consisted of a central station recording instrument, an engine house gong and a street box. The signals were given by magnetos, the impulses being obtained by ratchet wheels, operated by weights or springs. After testing the system on short circuit, a pair of No. 12 steel telephone wires from Springfield to Urbana, a total distance of 30 miles, was looped into the circuit. It was raining at the time, and the circuit showed considerable leakage, but the signals from the street box went through to the large gong with accuracy. Ninety miles of No. 12 copper wire, between Springfield and Columbus, was tried next, with perfect success, and, finally, coil resistance equal to 270 miles of No. 12 steel wire was placed in the circuit and still the gong responded to the call of the street box.

No battery being used for any part of the apparatus, and a closed circuit being used, the question arose as to how the central station could tell when the line wire was broken. To meet this condition, an ingenious but simple "tester" is used at the central station, consisting of a clock arrangement, wound once a week. Every five minutes, or oftener, if desired, the tester sends out over the line circuit a very high voltage impulse from a magneto, which is given a half turn by the clock work. If there is a break on the line a small gong will give one blow each time the tester cuts in. If the circuit is complete the tester moves along with nothing heard but the tick of the pendulum.

Several New York parties were present at the test, and it was immediately decided to form a construction company to place the invention on the market. The fire alarm is but one of the many uses proposed for the new system, as it is claimed it can be applied to telegraph lines, striking fog bells and changing colors of lights in light houses, bicycles with field telegraph in time of war, etc.

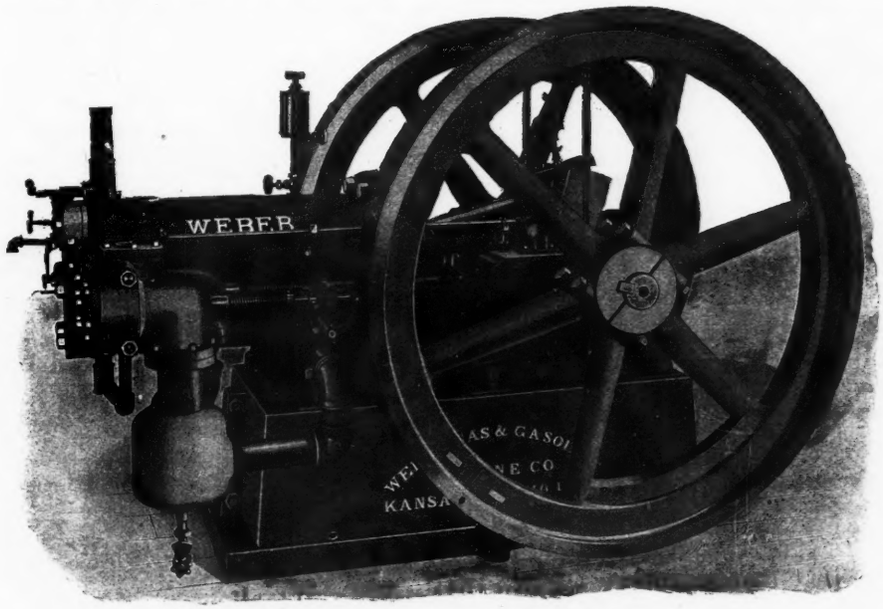
The inventor is Mr. L. G. Wooley, who has done a great deal of work with the magneto. He considers this the most valuable of the many patents he has taken out at various times. The invention is patented in the United States, England, Germany, France, Canada and other foreign countries.

ELECTRIC LIGHTING

The Saginaw, Mich., board of public works have under consideration the erection of a municipal lighting plant.

The village council of Algonac, Mich., has accepted the bid of Arbuckle, Ryan & Company to erect a complete electric light system for $12,225.

The Neversink Light and Power Company, incorporated, are to erect a $75,000 plant at Lock 51, on the Delaware & Hudson Canal, in New York state. The plant will supply at least 1,000 horse-power.



A Gas or Gasoline Engine for Electric Lighting.

The Middleburg & Schoharie Electric Light, Heat and Power Company, of Middleburg, N. Y., was incorporated recently to manufacture electricity for light, heat and power in Middleburg and in Schoharie. The company has a capital of $40,000, divided into $100 shares, and the directors are: Daniel D. Frisbie, G. N. Frisbie and Dow Beekman, of Middleburg.

The new power house of the Edison Electric Illuminating Company, now in course of construction on Atlantic avenue, opposite Pearl street, Boston, Mass., is expected to be roofed over late in the Fall. It is building on land which is assessed for $351,800, and which was acquired by the company in 1891. The steel trusses will rise to a height of 85 feet, and the walls will be of brick, three feet thick. The coal pockets will have a capacity of 34,000 cubic feet. There will be 20 boilers, horse-power, 8,360.

The Manchester Electric Company, of Manchester, N. H., one of the properties managed by Tucker, Anthony & Company, has just purchased the Merrimac Electric Light, Heat and Power Company, the Union Electric Company and the Consolidated Electric Company, all of Manchester, N. H. Messrs. Tucker, Anthony & Company will combine all of these interests with their present properties, which consist of the Manchester Electric Light Company, the Manchester Street Railway Company, the Franklin Electric Company and the Garvins Falls Power Company. The parent company now controls all the lighting, power and street railway interests of that section, including water power of 10,000 to 15,000 minimum horse-power, and 15,000 to 20,000 maximum.

Judge Martin Bell, of Blair County, Pa., rendered a decision of great importance upon the rights of the majority and minority stockholders in a corporation. Fifty-three per cent of the capital stock of the Edison Electric Illuminating Company, of Altoona, is owned by the Electric Company, of Philadelphia, Colonel A. Loudon Snowden, Joseph B. McCall and other Philadelphia capitalists. Forty-seven per cent of the capital stock is owned by Altoona capitalists. The minority stockholders, who were in control of the company, sought to issue 650 shares of new stock and auction the same to the highest bidder. The Philadelphia capitalists secured an injunction, alleging that their rights as majority stockholders were being endangered by this procedure. The court made the injunction perpetual. The electric plant in dispute is valued at a million dollars.

A Gas or Gasoline Engine for Electric Lighting.

In many situations in the world, such as mines in difficult mountainous country, practically the only kind of fuel that can be handled is gasoline or oil. For such situations a prime-mover using these fluids as fuel is highly desirable, especially if it combines good regulation and efficiency so as to make it useful for driving electric light apparatus.

The illustration herewith shows a type of engine, of 25 horse-power, using gas, oil or gasoline as fuel and built in sections for mountain transportation on mule-back. It is fitted with either tube or electric ignition, with wiper oilers and fixtures for long and continuous running. The valves are all of the direct-acting poppet type, lifting squarely from their seats without friction. Separate castings are provided for the valve seats so that these may be renewed when worn out. Circulating water surrounds the valve seats and this is claimed by the makers, the Weber Gas and Gasoline Engine Company, Kansas City, Mo., to be a feature of special importance since it results in prolonging the life of the valves and seats. The crank shafts are made steel forged and slotted out of solid billets and finished cold. The valve gear is enclosed in iron housing, dust and grit proof, and runs in oil. It is claimed that changes in temperature do not affect the operation of the engine, as no vaporizers or carburetters are used. The governor controls the feed of the fluid and is said to be very simple and positive in its operation. Engines of this type have been installed in a large number of mines and works where fuel is hard to handle. Some of the engines are working at altitudes approximating 12,000 feet above the sea-level in Mexico, the western part of the United States and British Columbia.

The directors of the Steubenville, Mingo & Ohio Valley Traction Company are figuring on another innovation for their new electric line. They contemplate putting in a complete telephone system which will practically connect the main office, power house and despatcher's office with every car in use on the road. By the system proposed a telephone will be placed on every car. Attached to these telephones will be a covered wire. On the sides of the trolley poles, the ends of the telephone wire will be fitted with a flat piece of metal with a hole in the centre. When a conductor wishes to communicate with the despatcher's office all he will have to do is to stop the car, insert the plug on the end of the covered wire in the metal cap on the pole and ring up the despatcher.

INDUSTRIAL NOTES

August Becker, 34 Oliver street, Boston, Mass., has every facility for making name plates for electrical manufacturers.

The Westinghouse Electric and Manufacturing Company recently shipped three dynamos to the power house of the Chinese Eastern Railroad, at Hong Kong.

D. L. Bates & Brother, Dayton, Ohio, are sending out literature covering the well-known Bates electric fans, which have enjoyed an especially large sale so far this season.

The Lea Electric Manufacturing Company, Elwood, Ind., has issued an advertising blotter showing, in an attractive manner, the company's 17-inch miniature enclosed arc lamp.

The Farr Telephone and Construction Supply Company, Chicago, has just issued Catalogue No. 14, covering complete lines of telephones and telephone appliances. The catalogue is comprehensive in every respect, and may be had free of cost upon application.

The Emerson Electric Manufacturing Company, St. Louis, Mo., is mailing to the trade Bulletin No. 3,020, describing its electric hack saws, equipped with alternating-current motors. The outfits are fully described in the bulletin, which may be obtained free on request.

The Electric Appliance Company, Chicago, has just issued its new telephone catalogue No. 15. It is most complete and up-to-date and is well arranged and handsomely printed. It should be in the hands of every one interested in telephones and telephone line construction.

The repeat orders for Cross oil filters, manufactured by the Burt Manufacturing Company, of Akron, Ohio, were as large and numerous in July as for the company's best year in 1899, and the increase over the midsummer months of a year ago is quite extraordinary.

"Meritable Soldering Stick" is the term applied to the Allen soldering stick by one of the progressive electrical houses when speaking of its sales of this commendable article. It is an award of true merit to a convenience rapidly gaining in favor with electrical men and dealers. The L. B. Allen Company, Incorporated, Chicago, manufacture the Allen soldering stick.

Time-table making has grown to be a fine art, as the new standard time-table folders Nos. 100 and 101, just issued by the passenger department of the New York Central & Hudson River Railroad, well illustrate. These are said to be the most elaborate and comprehensive railway folders ever printed. They contain general time tables of the Central and many connecting lines, and are beautifully illustrated with pictures and maps. British lines are illustrated in folder No. 101, while No. 100 devotes several pages to the Pacific Ocean steamship lines, sailing from various ports on the western coast of United States and Canada.

The Sprague Electric Company, of New York city, reports an unusually large and steadily increasing business along all the lines of its manufactures. The Lundell fans have had a big sale and the sales in the interior conduit department have exceeded all previous seasons. The company has just issued a revised edition of the bulletin describing the Greenfield flexible steel armored conductors. It contains additional illustrations and prices. Among other orders received for motors and generators is one from the Cooke Locomotive and Machine Company, of Paterson, N. J., for a standard 300-kilowatt, split-pole generator of the belted type.

Fred M. Locke, Victor, N. Y., manufacturer of insulators, has recently completed a large addition to his factory, which is running to its fullest capacity for the filling of several extremely large orders for high-tension insulators. One of the interesting orders which is being filled is for the two lines being constructed in California for power transmission, one of which is being built by the Bay Counties Power Company, of California, and the other by the Standard Electric Company, of California. These two lines together aggregate a total mileage of 560. The Locke factory is making insulators weighing 12 pounds each, of original design, for these lines. In the construction 50 poles to the mile will be used and the insulators will be mounted on large eucalyptus wood pins, with porcelain bases.

An improved long-life carbon brush has been put on the market by the Speer Carbon Company, of St. Marys, Pa., in which the manufacturers claim that the desirable quality of self-lubrication, combined with long life, has been attained, without danger of blackening or gumming the commutator. To attain these qualities a brush must be made of the finest obtainable material, and so treated as to close the pores of the carbon thoroughly, thus enabling the brush to take and give a high polish on the commutator. This special treatment should not increase the resistance of the brush to avoid heating, and the new Speer brush is claimed to combine these advantages, together with low resistance, long life, mechanical strength and entire absence of grit, which might cut or otherwise damage the commutator.

W. R. Ostrander & Company, 22 Dey street, New York, have just produced the twelfth edition of their catalogue, covering a large variety of electrical appliances and supplies for all sorts of domestic and business uses. Among other things treated of by the catalogue are electrical bell goods and material of all kinds, telegraph and telephone supplies, bell hangers and electrician's tools and hardware, speaking tube goods, annunciators, burglar and fire-alarm apparatus, batteries and battery material, electric gas-lighting apparatus, insulators, conduits, sockets, fuse blocks and other electric light fittings, switches of all kinds and descriptions, rheostats, panel boards, brackets and fixtures, shades, fan motors and small power motors, arc and incandescent lamps and, in general, all of the large variety of supplies that go to make up the stock of electrical supply houses. The catalogue is handsomely illustrated and contains 263 pages of descriptive matter.

Pencil vs. pen and ink pot—One day, just after the editor of a great daily paper had mislaid his Dixon "American Graphite," and been obliged to use a pen again, he sat down and wrote as follows: "The form of the stylus or steel pen changes, and the pigment and its vehicle vary, but this otherwise enlightened and lucky generation is as much the slave and the victim of the inkpot with its nasty contents as was the mediæval monk, the Roman or the Greek, or the Egyptian under the first dynasty, or the Chinamen of the time of Lien-Hwang, the Celestial. How many million lifetime units of muscular and nervous energy have been expended unnecessarily in the mere act of stretching the hand over to the inkstand tc dip the pen in this black liquid, relic of primeval barbarism? How many precious souls have been sent to perdition in consequence of the emotional upheaval over the besmeared fingers, the blot on the fair page or parchment, the inkbottle upset by the office cat! No wonder Martin Luther hurled his inkpot at the devil; that utensil fairly belongs to sheol. Away with pen and inkpot, and even the fountain pen! My kingdom for a lead pencil!"

The American Electric Fuse Company, Chicago, has just completed and put upon the market a new lightning arrester and cross-connecting distributing board. This is a new device, and, in addition to the fact that it is the latest on the market, it is cheap and efficient. The company has tested it carefully in practical use with telephone companies and absolutely guarantees its efficiency. These distributing boards are made in as many lines as desired, with carbon lightning arresters mounted on either slate or hardwood base, the latter being preferable, and afford perfect contacts for the wires at every point. The method of handling the wires as they come to the distributing board is unique. The wires occupy practically no space, being compactly and handily arranged for connection with the board. The mountings are all of the strongest polished brass, fitted with compact washers and distributing posts. For the better handling of the distributing wires, the company uses a lock-nut form of binding post, which screws the wires in place. A 50-line distributing board occupies a space of 3 feet 2 inches by 10 inches, with a height of 2 inches at the highest point. The company can fit up distributing boards for special purposes wherever desired, using porcelain or the ordinary hardwood base as required by the customer. The American Electric Fuse Company requests correspondence with any one interested in this kind of material, and will be pleased to furnish drawings and further explanation when desired.